May 2021

Binder 104, Heterophyidae A-B [Trematoda Taxon Notebooks]

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Heterophyidae Odhner,1914

Diagnosis (after Price,1940):

Synonyms: Coenogonimidae Nicoll,1907
Cotylogonimidae Nicoll,1907
Haplorchidae Travassos in Viana,1924
Stictodoridae Poche,1926

Small to very small flukes, usually oval to pyriform in outline; acetabulum usually enclosed in genital sinus; eyes absent; excretory vesicle Y-shaped, sometimes almost triangular, limbs not extending anterior to ovarian level; genital sinus variously modified and containing a cirrus-like body or gonotyl (genital sucker of authors); 1 to 2 testes, in posterior end of body; vitellaria usually inter- and extra-cecal.

Type genus: Heterophyes Cobbold,1866

Subfamilies:
Heterophyinae Ciurea,1924
Metagoniminae Ciurea,1924
Cryptocotylinae Luhe,1909
Apophallinae Ciurea,1924
Galactosominae Ciurea,1933
Centrocestinae Looss,1899
Haplorchiinae Looss,1899
Stellantchasminae Price,1939
Adleriellinae Witenberg,1930

Heterophyinae

Acetabulum not enclosed in genital sinus; gonotyl postero-lateral to acetabulum, bearing a row of chininoid rodlets.

Genera: Heterophyes Cobbold,1866
Heterophyopsis Tubangui and Africa,1939
Syn.: Pseudoheterophyes Yamaguti,1939
Knipowitschiatrema Isaichov,1927 according to Yamaguti,1939

Family HETEROPHYIDAE Odhner, 1914

Family diagnosis.—Small or very small forms, usually not exceeding 2 mm in length. Anterior portion of body thinner, usually more slender and more movable than the posterior portion. Surface of body covered with small scalelike spines that become reduced posteriorly and may disappear toward the posterior end of the body. Intestinal ceca simple, usually extending to the posterior end of the body. Genital pore in the immediate neighborhood of the acetabulum; genital ducts usually open into a genital sinus, which may be variously modified and contain a cirruslike body or gonotyl (genital sucker). Acetabulum usually median in position, but may be displaced to the right of the median line; in some instances the acetabulum may be partially or completely atrophied and inclosed in the genital sinus. Cirrus pouch absent. Seminal vesicle well developed, **U** or **S** shaped, the vas deferens surrounded proximally by a mass of prostatic cells. Testes oval, globular, or slightly lobed, near the posterior end of the body, side by side, or obliquely one in front of the other. Ovary oval, globular or slightly lobed, pretesticular, usually to the right of the median line. Seminal receptacle and Laurer's canal present near the ovary, usually in relation with its posterior border. Vitellaria, located mainly in the lateral fields, may extend anteriorly to or beyond the genital aperture. Uterus usually restricted to the intercecal field between the ovary and genital pore, but may extend to posterior end of body (*Galactosomum*). Adults parasitic in the intestine of birds and mammals.

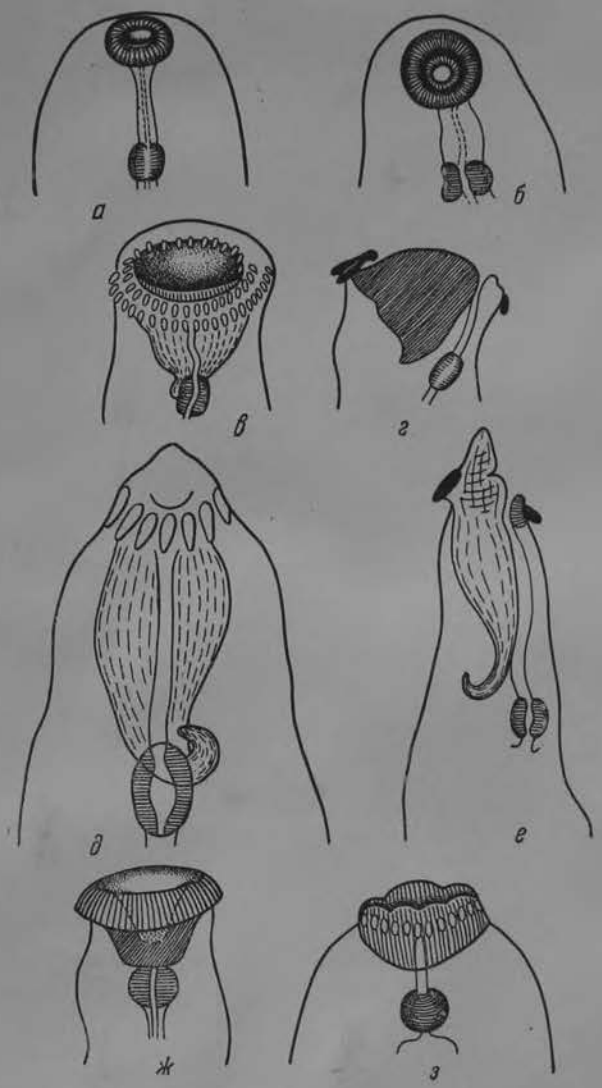
Type genus.—*Heterophyes* Cobbold, 1866.

KEY TO THE GENERA OF HETEROPHYIDAE OCCURRING IN MARINE MAMMALS

1. Acetabulum absent; uterus extending to posterior end of body. **Galactosomum** (p. 39).
   Acetabulum present; uterus not extending caudally beyond anterior border of testes ---- 2.
2. Acetabulum not contained in the genital sinus; seminal receptacle median and slightly preovarial; vitellaria not extending to acetabulum ---- **Phocitrema** (p. 38).
   Acetabulum contained in the genital sinus; seminal receptacle lateral and postovarial; vitellaria extending cephalad of acetabulum ---- 3.
3. Genital sinus large; genital ducts open into sinus caudad of acetabulum ---- **Cryptocotyle** (p. 33).
   Genital sinus small; genital ducts open into sinus cephalad of acetabulum ---- **Apophallus** (p. 35).

Agrees with Opisthorchidae in
1. miracidium with 1 pr. flame cells
2. Cercariae develop in rediae
3. cercariae are pleurolophocercous
4. "Stenostoma" type of excretory system
5. Encyst in fish
6. ~~Adult in alimentary canal~~

Anterior ends of some Heterophyidae (from Skrjabin,1952)



38. Передние концы тела гетерофиоид

а — передний конец *Heterophyes heterophyes* (Siebold, 1852) (по Витенбергу, 1929); *б* — передний конец *Ponticotrema euxini* Issaitschikoff, 1927 (по Исайчикову, 1927); *в* — передний конец *Ascocotyle megalocephala* Price, 1932 (по Прайсу, 1932); *г* — то же в вентральном разрезе; *д* — передний конец *Parascocotyle ascolonga* Witenberg, 1929 (по Витенбергу, 1929); *е* — то же в сагиттальном разрезе; *эс* — передний конец *Cryptogonimus chili* (Osborn, 1903) (по Ван Кливу и Мюллеру, 1932); *з* — передний конец *Neochasmus umbellium* Van Cleave et Mueller, 1932 (по Ван Кливу и Мюллеру, 1932)

HETEROPHYIDAE Odhner, 1914

Family diagnosis. — Small or very small distomes covered with scale-like spines. Oral sucker and pharynx present. Ceca long or short, exceptionally single; occasionally they may open to the outside or into the excretory vesicle. Acetabulum well developed or atrophied, rarely lacking, median or submedian, may or may not be enclosed in genital atrium. Testes tandem, diagonal or symmetrical, occasionally single, in posterior half of body. Vesicula seminalis well developed. Cirrus pouch absent. Genital atrium variously modified, containing one or more gonotyl, and often acetabulum as well. Ovary usually submedian, pretesticular. Receptaculum seminis and Laurer's canal usually present. Vitellaria diffuse or forming groups of follicles, usually in lateral field of hindbody. Uterus coiled between genital pore and testes or posterior extremity, may or may not reach to lateral margins of body; eggs small, embryonated. Excretory vesicle variable, V-, Y- or T-shaped, occasionally saccular; stem with side branches or not. Intestinal parasites of vertebrates.

Type genus: *Heterophyes* Cobbold, 1886.

Key to subfamilies of Heterophyidae from mammals [1])

1. Body wider than long; excretory vesicle T-shaped ..... Euryhelminthinae
   Body longer than wide, excretory vesicle V- or Y-shaped .. 2
2. Acetabulum lacking; ceca very short, ovary posttesticular ..... Adleriellinae
   Acetabulum present; ceca long; ovary pretesticular 3
3. Common genital sucker present ..... Heterophyinae
   Common genital sucker absent 4
4. Vitellaria more or less extensively developed 5
   Vitellaria limited in extent 8
5. Uterus reaching to posterior extremity ..... Galactosominae
   Uterus not reaching to posterior extremity 6
6. Vitellaria usually in hindbody for most part; circumoral crown of spines absent ..... Apophallinae
   Vitellaria extending further forward 7
7. Circumoral crown of spines present; acetabulogenital apparatus simple ..... Centrocestinae
   Circumoral crown of spines absent; acetabulogenital apparatus complex ..... Cryptocotylinae
8. Oral sucker drawn out posteriorly in form of a funnel, circumoral crown of spines present ..... Ascocotylinae
   Oral sucker not drawn out posteriorly 9
9. Uterus reaching posterior extremity 10
   Uterus usually not exactly reaching posterior extremity ... 11
10. Testes single, near posterior extremity ..... Haplorchiinae
    Testes usually asymmetrical, more or less widely separated from posterior extremity; acetabulogenital apparatus complex ..... Stictodorinae
11. Genital pore definitely out of median line ..... Metagoniminae
    Genital pore median or nearly so ..... Pygidiopsinae

[1]) *Tauridiana* Issaitschikow 1925 [*T. pontica* Issaitsch., 1925 (Pl. 99, Fig. 1199), n dog; Crimea] has been omitted from the key owing to inadequate description.

Key to subfamilies of Heterophyidae from birds

1. Forebody with wing-like lateral expansions .. Scaphanocephalinae
   Forebody without wing-like lateral expansion 2
2. Common genital sucker present, ceca long ..... Heterophyinae
   Common genital sucker present, ceca with anterior diverticula ..... Tetracladiinae
   Common genital sucker absent, ceca variable in length ... 3
3. Vitellaria more or less extensively developed 4
   Vitellaria limited in extent 7
4. Uterus reaching to posterior extremity ..... Galactosominae
   Uterus not reaching to posterior extremity 5
5. Vitellaria usually in hindbody for most part; circumoral crown of spines absent ..... Apophallinae
   Vitellaria extending further forward 6
6. Circumoral crown of spines present; acetabulogenital apparatus simple ..... Centrocestinae
   Circumoral crown of spines absent; acetabulogenital apparatus complex ..... Cryptocotylinae
7. Oral sucker drawn out posteriorly in form of a funnel; circumoral crown of spines present ..... Ascocotylinae
   Oral sucker not drawn out posteriorly 8
8. Uterus reaching posterior extremity 9
   Uterus usually not exactly reaching posterior extremity ... 10
9. Testes single, near posterior extremity ..... Haplorchiinae
   Testes usually asymmetrical, more or less widely separated from posterior extremity; vitellaria in posttesticular lateral fields ..... Stictodorinae
   Testes diagonal, near posterior extremity; vitellaria in pretesticular lateral fields; circumoral crown of spines present ..... Opisthometrinae
10. Genital pore definitely out of median line .....Metagoniminae
    Genital pore median or nearly so ..... Pygidiopsinae
    Appendix: Adult form unknown ..... Novemtestiinae

Heterophyidae Odhner, 1914, emend.

Body anteroposteriorly elongated or almos
isodiametric. Intestinal ceca variable in length
rarely single. Ventral sucker well developed
or atrophied, may or may not be included i
genital atrium, latter including one or mor
gonotyls. Testes tandem, diagonal, symmetrica
or asymmetrical, rarely single. postacetabular
Cirrus sac absent. Seminal vesicle well de
veloped. Vitelline glands lateral, usually ex
tending from ventral sucker to testicular regio
Seminal receptacle and Laurer's canal usuall
present. Uterus variable in length. Excretor
vesicle saccate, V-, Y-, or I-shaped, occasionall
with lateral branches from posterior region of
main stem.

FROM NASIR AND DÍAZ (1971)
PROC. HELM. SOC. WASH. 38: 21-25

KEY TO THE SUBFAMILIES OF HETEROPHYIDAE ODHNER, 1914

1. Two testes; vitellaria and uterine coils primarily post-acetabular 2
1. Multiple testes; vitellaria and uterine coils primarily pre-acetabular ..... Larelminthinae n. subfam.
2. Anterior sucker simple; without spines or other protuberances 3
2. Anterior sucker with one or two rows of coronal spines ..... Centrocestinae Looss, 1899
3. Acetabulum connected with genital sinus 4
3. Acetabulum well-developed and not enclosed in a genital sinus; gonotyl large, with citinous spines ..... Heterophyinae Ciurea, 1924
4. Genital sinus median 5
4. Genital sinus lateral ..... Metagoniminae Ciurea, 1924
5. Gonotyl with only one papilla 6
5. Gonotyl with two papillae ..... Apophallinae Ciurea, 1924
6. Genital sucker smaller than, and anterior to acetabulum; body wider at mid-body; uterus short ..... Euryhelminae Morozov, 1952
6. Genital sucker larger than, and posterior to acetabulum; uterus well-developed ..... Cryptocotylinae Ciurea, 1924

Lautenschlager & Chang, 1958

Heterophyinae Ciurea, 1924

Subfamily diagnosis. — Heterophyidae: Body elongate to oval; oral sucker, small, prepharynx long, esophagus of moderate length, sometimes very short; ceca long, terminating at posterior extremity. Acetabulum well developed, median, in close proximity to genital pore or separated from it, equatorial or pre-equatorial. Testes symmetrical or tandem, intercecal, at or near posterior extremity. Seminal vesicle bi- or tripartite. Male and female genital pores united and then opening in center of sucker-like pad. Common genital pore posterolateral to acetabulum. Ovary median or a little submedian, pretesticular. Receptaculum seminis and Laurer's canal present. Uterus may or may not extend to posterior extremity, overreaching ceca but little, if at all; eggs small, numerous. Vitellaria limited in extent, forming paired pretesticular bunches of follicles or extending some distance in lateral fields of hindbody. Excretory vesicle Y-shaped. Parasites of mammals and birds.

Key to genera of Heterophyinae from mammals

Testes juxtaposed; vitellaria forming symmetrical pretesticular bunches ..... *Heterophyes*

Testes tandem or diagonal; vitellaria extending in lateral fields ..... *Heterophyopsis*

Heterophyes Cobbold, 1886

Syn. *Mesogonimus* Monticelli, 1888
Coenogonimus Looss, 1899
Cotylogonimus Lühe, 1899

Generic diagnosis. — Heterophyidae, Heterophyinae: Small to very small distomes covered with scale-like spines. Oral sucker subterminal, prepharynx distinct, pharynx small; **esophagus comparatively long;** ceca terminating at posterior extremity. **Acetabulum well developed, situated** in middle third of body, or a little more anteriorly. **Testes juxtaposed** or somewhat oblique, at cecal ends. No **cirrus pouch. Genital pore sucker-**like, with a crown of spines, opening posterolateral to acetabulum. Ovary median, pretesticular. Vitellaria on each side of hindbody, anterior and anterolateral to testes. Uterus coiled between testes and acetabulum. Excretory vesicle Y-shaped, stem passing between two testes and bifurcating between ovary and testes. Metacercaria in fishes. Parasitic in digestive tract of birds and mammals.

Genotype: *H. heterophyes* (Siebold, 1853) Stiles et Hassall, 1900 (Pl. 87, Fig. 1049), syn. *Heterophyes aegyptiaca* Cobbold, 1866; *Mesogonimus h.* Railliet, 1890; *Coenogonimus h.* Looss, 1900; *Cotylogonimus h.* Lühe, 1900.

H. fraternus (Looss, 1984) — Witenberg (1929), in man, cat, dog, and *Rhinolophus clivosus acrotis;* Egypt, Japan, China. Also in *Milvus migrans, M. parasiticus, Pelecanus onocrotalus,* fox, wolf, weasel.

Oculate lophocercous cercaria with a longitudinal series of seven penetration glands develops in *Tympanotomus microptera* — Asada (1928); metacercaria in *Mugil, Epinephelus, Tilapia, Lichia, Barbus;* Palestine — Ciurea (1931); cercaria in *Melania tuberculata* and *Cleopatra bulimoides* — Faust (1929); lophocercous cercaria develops in *Pirenella conica,* encysts in *Mugil cephalus,* experimentally also in laboratory-bred *Gambusia,* infected fish fed to dog with positive result — Khalil (1933, 34, 37, 39). Metacercaria from *Mugil* spp., *Pirenella, Epinephelus, Tilapia, Lichia, Barbus;* adult experimentally in *Circaetus gallicus* and rabbit — Balozet and Callot (1939).

Other species from mammals:

H. aequalis Looss, 1902, in dogs and cats; Egypt.

H. dispar Looss, 1902, syn. *H. dispar limatus* Looss, 1902, in dogs and cats; Egypt. Also experimentally in "lapin" and "loup de Perse" — Balozet & Callot (1939).

Metacercaria in *Mugil, Epinephelus, Tilapia, Lichia,* and *Barbus* — Ciurea (1931).

H. elliptica Yokogawa, 1913, in *Canis familiaris;* Formosa.

H. katsuradai Ozaki et Asada, 1926, in man, dog; Japan. Vector fish: *Mugil cephalus* — Asada (1926).

H. nocens Onji et Nishio, 1916, ?syn. of *H. heterophyes,* in man, experimentally also in dog, cat, and rat. Vector fish: *Mugil, Liza, Acanthogobius* and *Chaenogobius.* Cercaria develops in *Tympanotomus microptera.*

H. persica (Braun, 1901) Looss, 1902, syn. *Cotylogonimus p.* B., syn. of *H. heterophyes* — Witenberg (1929), in Persian wolf; Germany (Berlin Zoo).

Genotype: *H. heterophyes* (Siebold, 1852) Stiles et Hassall, 1900 (Pl. 87, Fig. 1049), syn. *H. aegyptiaca* Cobb., 1866; *H. h. sentus* Looss in Witenberg, 1929, in man, cats and dogs; Egypt, Japan, China. Also in fox, wolf, wiesel, *Milvus migrans, M. parasiticus, Pelecanus onocrotalus.* Vector fish: *Mugil cephalus.*

Representatives from birds:

H. fraterna (Looss, 1894) Looss, 1902, syn. *Coenogonimus fraternus* (L.) Jaegersk., 1903; *Cotylogonimus fraternus* (L.) Braun, 1901, syn. of *H. heterophyes* — Witenberg (1929), in *Pelecanus onocrotalus;* Egypt. Also in *Milvus migrans;* Egypt.

Metacercaria in *Mugil;* adult in cat and dog.

H. indica Rao et Ayyar, 1931, in dogs. (Nomen solum).

H. inops Looss, 1902, in *Pelecanus onocrotalus* and *Milvus aegypticus;* Egypt.

H. pallida Looss, 1902, syn. of *H. heterophyes* — Lane and Low (1923), Witenberg (1929), in *Milvus aegypticus;* Egypt.

HETEROPHYES

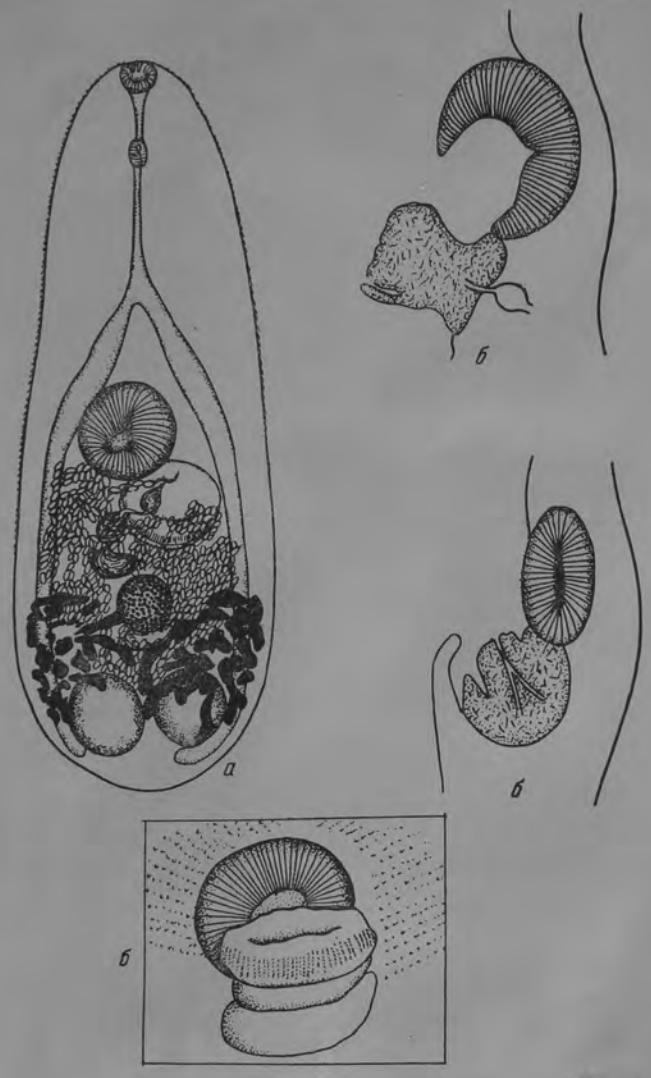
Small to very small distomes covered with scale-like spines. Oral sucker subterminal, prepharynx distinct, pharynx small; esophagus comparatively long; ceca terminating at posterior end. Acetabulum well developed, situated in middle third of body, or a little more anteriorly. Testes juxtaposed or somewhat oblique, at cecal ends. No cirrus pouch. Genital pore sucker-like, with a crown of spines, opening posterolaterally to acetabulum. Ovary median, pretesticular. Vitellaria on each side of hindbody, anterior and anterolateral to testes. Uterus coiled between testes and acetabulum. Excretory vesicle Y-shaped, stem passing between testes and bifurcating between ovary and testes. Metacercaria in fishes. Parasitic in digestive tract of birds and mammals.

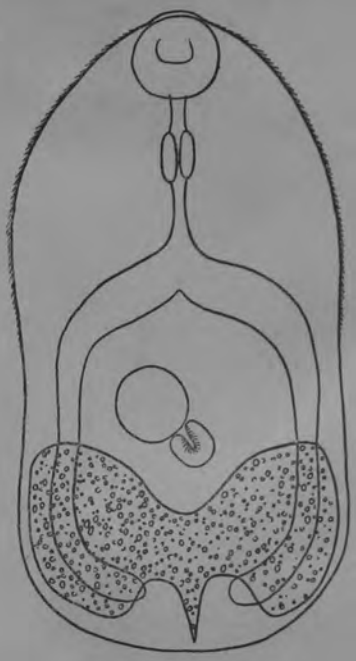
Genotype: H. heterophyes (Siebold, 1853) Stiles & Hassall. 1900

Heterophyes heterophyes (Siebold,1853) Stiles & Hassall,1900

Hosts: man,cat,dog, fox, wolf, weasel, Rhinolophus clivosus acrotis; also Milvus migrans, M.parasiticus, Pelecanus onocrotalus. Metacercariae in Mugil, Epinephelus, Tilapia,Lichia,Barbus.

Cercariae in Melania tuberculata, Cleopatra bulimoides.





52
Metacercaria

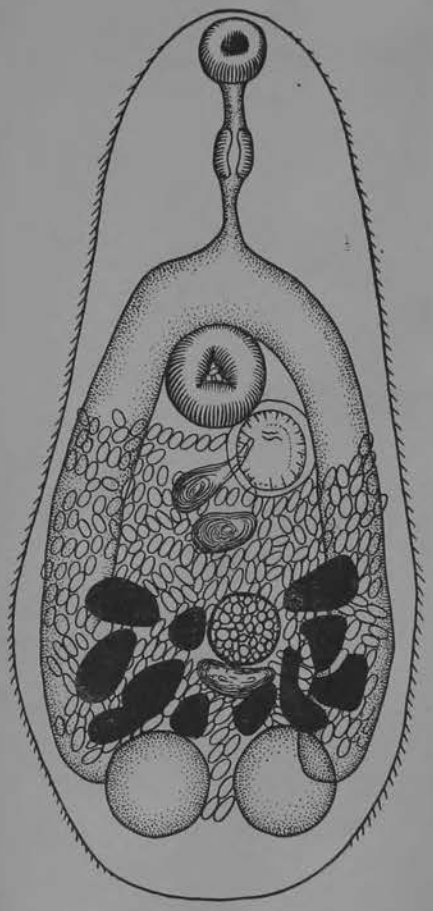
FAMILY HETEROPHYIDAE ODHNER, 1914
GENUS *Heterophyes* CORBOLD, 1886
H. heterophyes (Siebold, 1853)

This species, common in man and certain carnivores of the Middle and Far East, was collected by Kuntz and reported by Macy, 1953. Two specimens were taken from *Rhinolophus clivosus acrotis*, February 14, 1951, at Sana', Yemen. It is the first record of the species in a bat.

FROM MACY, HEYNEMAN & KUNTZ, 1961

Heterophyes aequalis Looss,1902

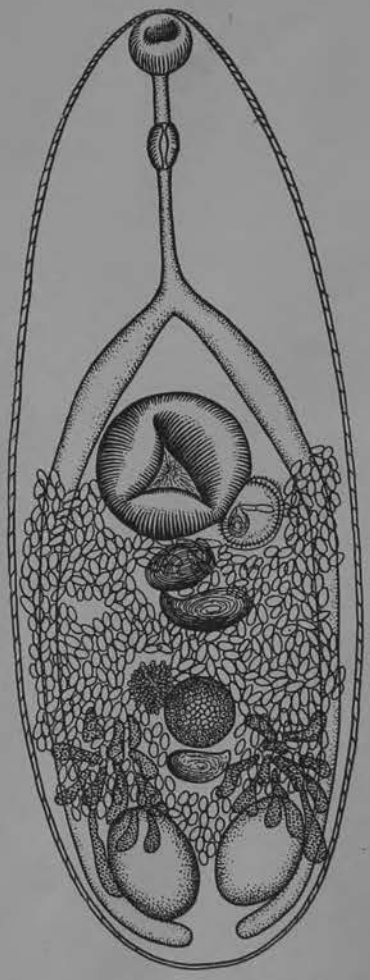
Hosts: cat,dog, pelecan, Milvus aegypticus
Metacercaria in Mugil, Epinephelus, Tilapia,Lichia



Heterophyes dispar Looss,1902

Host:

Metacercaria in Mugil, Epinephelus, Tilapia, Lichia, Barbus

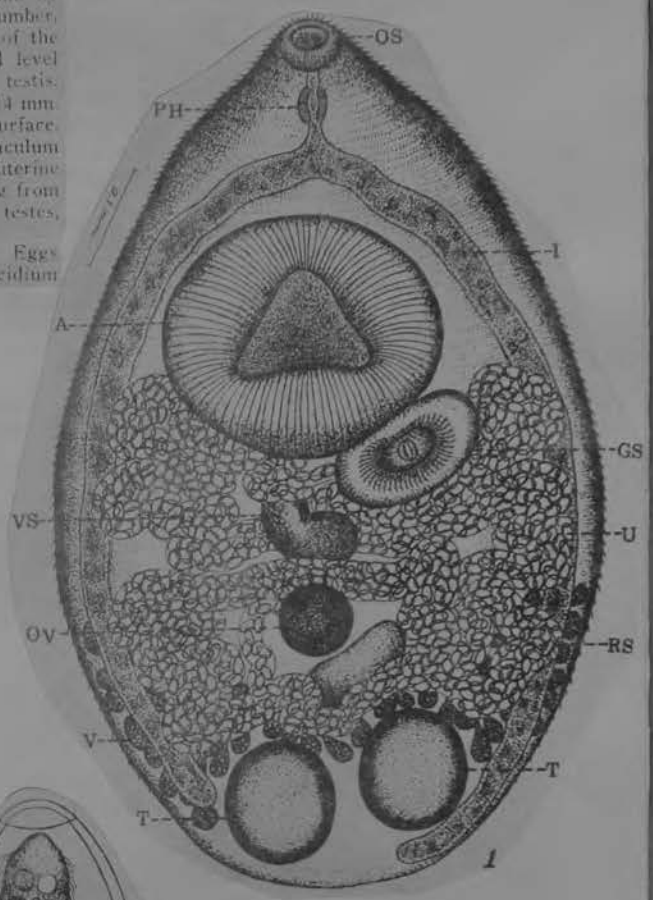


Heterophyes katsuradai —— Ozaki and Asada, 1926

Length 0.61 to 0.89 mm.; maximum width 0.40 to 0.47 mm., short oval, anterior end pointed, posterior end obtuse. Cuticula with spines. Oral sucker globular, 61 to 63μ in diameter; acetabulum very large 195 to 220μ in diameter, on the boundary between the cephalic and middle thirds of the body. Genital sucker on the left side of and behind the acetabulum, 0.11 to 0.14 mm. by 0.07 to 0.085 mm. Chitinous rodlets of the genital sucker 52 to 57 in number, each with four pointed lateral processes directed towards the free end of the rodlet. Intestinal cecum of the right side always ending at the central level of the right testis, that of the left frequently extending beyond the left testis. Testes globular, right testis somewhat more posterior than left, 0.08 to 0.14 mm. in diameter. Seminal vesicle behind the acetabulum under the dorsal surface. Ovary 55 to 92μ in diameter, in the median line in front of testes. Receptaculum seminis on the left side of and behind the ovary, about 0.11 by 0.06 mm.; uterine coils filling up spaces between testes and acetabulum. Vitellaria extending from the level of the anterior border of the ovary to the central level of the testes, those of the two sides coalescing at the anterior border of the testes. Eggs thick shelled, yellowish brown, 25.3 to 25.9μ long, 14.3 to 15μ wide. Miracidium ciliated, developed in the uterus.

Habitat: Intestine of man.

Locality: Kobe, Japan.



Heterophyes nocens Onji et Nishio, 1915

Синоним: *Mesogonimus heterophyes* Railliet, 1890, частично

Дефинитивные хозяева: человек, собака.

Дополнительные хозяева: *Mugil cephalus, M. japonicus.*

Промежуточный хозяин: моллюск — *Typhanotus microptera.*

Локализация: взрослые — в кишечнике дефинитивного хозяина; метацеркарии — в мышцах и брюшине рыб.

Место обнаружения: Япония.

Описание вида (по Корту и Иокогава, 1921). Тело 0,9—1,10 мм длины и 0,4—0,52 мм ширины. Кутикула покрыта шипиками, не имеющими зубчиков на заднем крае. Ротовая присоска 0,08 мм в диаметре. Кишечные ветви неодинаковой длины: одна ветвь заканчивается впереди наружного края заднего семенника, другая примыкает к экскреторному пузырю. Брюшная присоска 0,20—0,22 мм в диаметре. Половое отверстие окружено половой присоской, снабженной хитиновыми гребнями в количестве около 60. Яйца 0,028 мм длины и 0,015 мм ширины.

Этот вид отличается от других видов количеством хитиновых гребней на половой присоске, различной длиной кишечных ветвей и меньшими размерами всех органов.

Метацеркарии инцистируются в мышце и брюшине рыб рода *Mugil.* Циста круглой или эллиптической формы; ее диаметр — 0,163××0,136 мм. Стенка самой цисты состоит из двух слоев. Личинка, освобожденная от цисты, достигает 0,34×0,15 мм. Брюшная и половая присоски находятся немного позади середины тела. Ротовая присоска 0,049 мм в диаметре, брюшная 0,045 мм и половая 0,025 мм в диаметре. Размер фаринкса 0,029×0,026 мм. Экскреторный пузырь треугольной формы и наполнен сильно преломляющей свет массой.

В окончательном хозяине достигают вполне взрослой стадии через 8 дней после заражения.

PSEUDOHETEROPHYES Yamaguti,1939

A synonym of Heterophyes aac Price,1940

Pseudoheterophyes continua (Onji et Nishio, 1924)

Синоним: *Heterophyes continua* Onji et Nishio, 1924

(Рис. 56)

Дефинитивный хозяин: *Larus argentatus vogae* Palmen.
Промежуточные хозяева: неизвестны.
Локализация: тонкие кишки.
Место обнаружения: Япония.

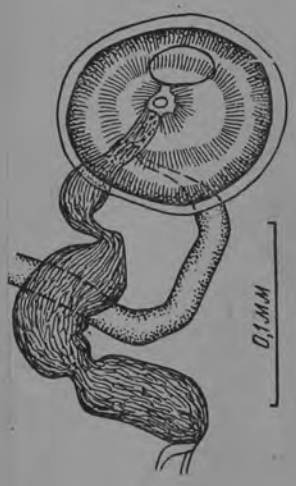
Описание вида. Тело удлиненное, сплющенное дорзо-вентральное в передней части и цилиндрическое в задней, 1,97—2,05 мм длины при ширине 0,24—0,28 мм на уровне брюшной присоски. Кутикула покрыта на всем протяжении микроскопическими шипиками. Ротовая присоска 0,060—0,066×0,075—0,078 мм в диаметре. Длина префаринкса 0,26—0,33 мм. Размер фаринкса 0,063—0,060×0,036—0,050 мм. Пищевод очень короткий; его длина достигает 0,060 мм. Кишечные ветви заканчиваются у заднего края тела. Брюшая присоска 0,12—0,14 мм в диаметре, лежит в передней части средней трети тела. Семенники овальные до кругловатых, 0,15 — 0,165×0,13 —0,14 мм, расположены один за другим в задней трети тела. Семенной пузырек состоит из двух частей и соединяется коротким, узким каналом с булавовидным концевым органом, лежащим дорзально в отношении половой присоски и соединенным своим передним концом с метратермом.

Половая присоска 0,080—0,100 мм в диаметре, лежит немного позади брюшной присоски, влево от средней линии. На половой присоске имеется около 100 шипиков, расположенных по кругу. Гермафродитный канал 0,015—0,018 мм в наружном диаметре, окружен мускулистым кольцом. Яичник округлый, 0,114—0,120×0,096—0,100 мм, лежит около границы между средней и задней третью тела. Семяприемник округлый, 0,050—0,060 мм в диаметре, расположен позади, справа и дорзальнее яичника.

Матка достигает заднего конца тела. Яйца овальные, светлокоричневые, с толстой оболочкой, 0,025—0,026 мм длины и 0,014—0,016 мм ширины. Желточники по бокам тела тянутся от задней части семенного пузырька до переднего края заднего семенника. Экскреторный пузырь лежит дорзально; его медианный ствол изогнут S-образно и достигает яичника.

Литература: Onji and Nishio, 1924, стр. 89—90; Yamaguti, 1939, стр. 151.

а



б

Heterophyes persica (Braun, 1901) Looss, 1902
syn. Cotylogonimus persica Braun, 1901

"Cotylogonimus persicus Ban. after Braun" From Pratt, 1902

HETEROPHYES

Acanthotrema Travassos, 1928

Generic diagnosis. — Heterophyidae, Stictodorinae: Body flattened, elongate, spinose. Oral sucker subterminal, prepharynx extremely long, pharynx small, esophagus very short. Ceca long, narrow, reaching to near posterior extremity. Acetabulum enclosed in genital atrium? Testes rounded, postequatorial, obliquely tandem. Seminal vesicle sinuous, cirrus pouch absent. Genital pore pre-equatorial, with three protrusible hooks. Ovary round, pre-equatorial, median. Receptaculum seminis voluminous, posterior to ovary. Vitelline follicles small, sometimes difficult to observe, posttesticular, median, enclosed in uterine coils. Uterus intercecal and cecal, extending posterior to testes; eggs small. Excretory vesicle? Intestinal parasites of birds.

Genotype: *A. acanthotrema* Travassos, 1928, in *Sterna maxima;* Rio de Janeiro; figure not given. Assigned to *Stictodora* — Witenberg, 1953.

Yamaguti, 1958

ACANTHOTREMA

Adleriellinae Witenberg, 1930

Subfamily diagnosis. — Heterophyidae: Body very small, oval to fusiform. Oral sucker rather small, prepharynx long, pharynx large, esophagus short, ceca very short. Acetabulum lacking. Testes single, in middle third of body. Seminal vesicle divided into two sacs. No cirrus pouch. Genital atrium occupied by spined globular gonotyl, median, at level of anterior end of testis. Ovary median, posteroventral to testis. Receptaculum seminis large. Uterus filling all available space of hindbody. Vitellaria in two dorsolateral fields of hindbody. Excretory vesicle unknown. Intestinal parasites of mammals.

Adleriella Witenberg, 1930

Syn. *Adleria* Witenberg, 1929, preoccupied

Generic diagnosis. — Heterophyidae, Adleriellinae: Body very small, oval to fusiform, spinose. Oral sucker subterminal, followed by distinct prepharynx. Pharynx large, esophagus short, ceca very short. No acetabulum? Testes single, median, postequatorial, close to dorsal cuticle. Seminal vesicle anteroventral to testis, median, constricted into two globular sacs. Genital atrium filled with globular gonotyl bearing two large and two small spines situated medianly, at level of anterior end of testis. Ovary median, posteroventral to testis. Receptaculum seminis large, posttesticular. Vitellaria scattered under dorsal cuticle, in posterior half of body. Uterus occupying all available space posterior to seminal vesicle; eggs small. Excretory vesicle? Intestinal parasites of mammals.

Genotype: *A. minutissima* (Witenberg, 1929) (Pl. 91, Fig. 1095) in dog and cat; Palestine.

Metacercaria in fishes such as *Discognathus* sp., *Varicorhinus* sp., *Barbus canis*, *Mugil cephalus*, *M. capito* — Witenberg (1929).

Adleriella minutissima (Witenberg, 1929)

Синоним: *Adleria minutissima* Witenberg, 1929

(Рис. 139)

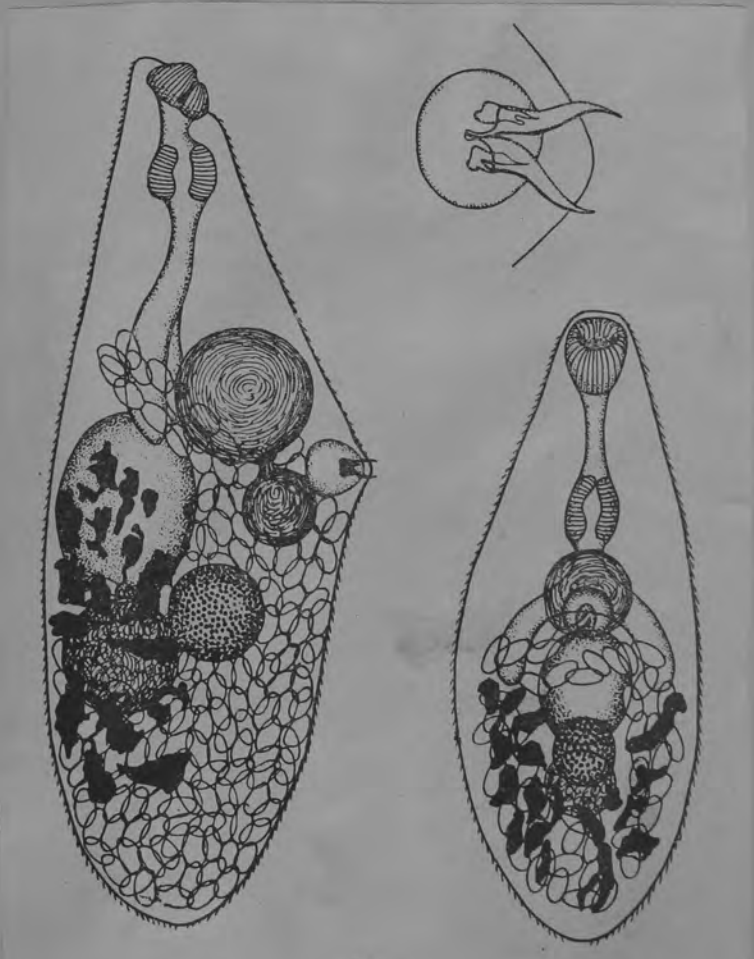
Дефинитивные хозяева: собака (*Canis familiaris*), кошка (*Felis catus domesticus*).

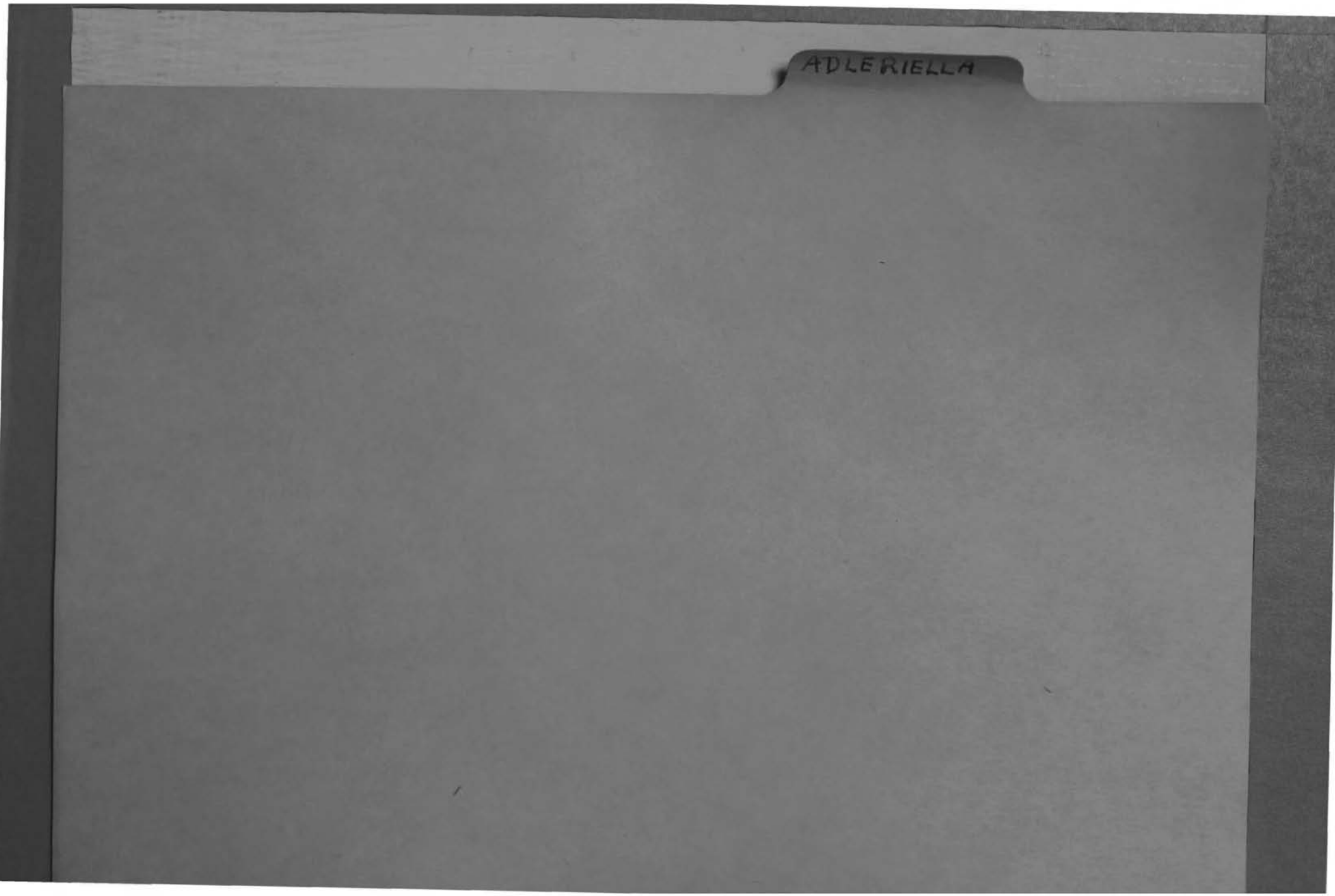
Дополнительные хозяева: рыбы — *Discognatus* sp., *Varicortinus* sp., *Barbus canis*, *Mugil cephalus*, *M. capito*.

Локализация: взрослые — в кишечнике окончательного хозяина; метацеркарии — в тканях рыб.

Место обнаружения: Палестина.

Описание вида (по Витенбергу, 1929). Очень мелкие трематоды, 0,27—0,47 мм длины и 0,09—0,1 мм ширины. Тело грушевидное или веретенообразное, округлое в поперечном сечении. Кутикула покрыта толстыми шипами, отсутствующими только вокруг ротового, генитального и экскреторного отверстий. Ротовая присоска 0,025—0,034 мм ширины расположена субвентрально. За нею следует очень сильно сокращенный префаринкс 0,015—0,050 мм длины, который в три раза короче при сокращении, чем при растяжении. При сокращении он тащит кишечные ветви вверх. Фаринкс 0,025—0,031 мм, пищевод 0,06—0,18 мм длины. Кишечные ветви короткие, оканчивающиеся перед серединой тела при сокращенном префаринксе и позади него при растянутом префаринксе. Имеется лишь один овальный семенник 0,04—0,10 мм длины, с длинной продольной осью. Он расположен позади середины тела, под дорзальной ее поверхностью; сзади семенника лежит круглый семяприемник 0,043—0,084 мм в диаметре. Вентрально к семенникам и семяприемнику




ADLERIELLA

Apophallinae Ciurea, 1924

Subfamily diagnosis. — Heterophyidae: Body elongate to pyriform or elliptical. Oral sucker rather small, exceptionally very large. Esophagus long, ceca terminating at or near posterior extremity. Acetabulum enclosed in genital atrium, may be large or small, median. Testes diagonal, occasionally juxtaposed, near posterior extremity. Seminal vesicle winding or divided. Genital pore median in middle third of body, sometimes more anteriorly. Ovary submedian, pretesticular; receptaculum seminis present. Uterus anterior to testes. Vitellaria extending in lateral fields almost whole length or greater part of intestine. Excretory vesicle Y-shaped. Parasites of birds and mammals.

Apophallus Lühe, 1909

Syn. *Cotylophallus* Ransom, 1920

Rossicotrema Skrjabin et Lindtrop, 1919

Generic diagnosis. — Heterophyidae, Apophallinae: Body small, very much elongated, flattened, spined. Oral sucker small, prepharynx present, esophagus long, ceca terminating at or near posterior extremity. Acetabulum equatorial or pre-equatorial, opening into genital atrium. Testes rounded, tandem or oblique, near posterior extremity. Seminal vesicle large, pars prostatica weakly developed. No cirrus pouch. Genital pore immediately pre-acetabular. Genital atrium deep, widened toward its opening, filled with retort-shaped papilla, beside the base of which open the male and female ducts. Ovary round, submedian, with receptaculum seminis immediately posteromedially. Laurer's canal present. Uterus short; eggs comparatively large. Vitellaria in lateral fields of hindbody, may be confluent in inter- and posttesticular area. Excretory vesicle Y-shaped; stem long, sigmoid, passing between two testes. Intestinal parasites of birds and mammals.

Genotype: *A. muehlingi* (Jägerskiöld, 1899) Lühe, 1909 (Pl. 78, Fig. 954), syn. *Tocotrema m.* (J.) Looss, 1899; *Mesorchis oesophagolongus* Katsurada — Ciurea (1924), in *Larus ridibundus;* Pillau. Also in dog, cat, *Larus argentatus cachinnans, L. ridibundus, L. canus, Pelecanus onocrotalus, Himantopus himantopus, Cancroma cochlearis, Phalacrocorax pigmeus, Colymbus septentrionalis,* etc.; Europe (Rumania, Poland).

Metacercaria encysted in flesh and fins of cyprinids, especially in *Abramis brama, Leuciscus rutilus, Perca fluviatilis, Blicca björkna, Sardinius erythrophthalmus* — Ciurea (1930, 33), Prettenhoffer (1930).

Key to species — Morozov in Skrjabin (1952).

Other species:

A. americanus Van Cleave et Mueller, 1932, from *Stizostedion vitreum* and *Perca flavescens*, may be an accidental parasite due to secondary transmission.

A. bacalloti Morosov, 1952, for *Apophallus* sp. of Balozet and Callot, 1939, in *Botaurus stellaris;* Tunis.

A. brevis Ransom, 1920, syn. of *Rossicotrema donicum* Skrj. et Lind. — Witenberg (1929), in *Larus delawarensis*, U.S.A.; *Gavia immer*, Canada.

Cercaria develops in *Amnicola limosa*, encysts in *Salvelinus fontinalis, Salmo fario*, speckled trout (black spot disease) — Miller (1941, 42); cercaria — Miller (1946).

A. crami Price, 1931, in *Larus californicus;* N. America.

A. donicus (Skrj. et Lindtrop, 1919) Price, 1931, syn. *Rossicotrema d.* S. et L.; *Cotylophallus venustus* Ransom, 1920; *C. similis* Ransom, 1920; in dog, cat, rat, and rabbit (exper.), *Vulpes lagopus*. Also in *Buteo buteo, Asio otus, Ciconia ciconia, Mergus merganser, Columba livia, Nycticorax nycticorax, Larus ridibundus, Sterna cantiaca, Coturnix communis, Turtur communis.*

Metacercaria in *Perca, Lucioperca, Blicca, Acerina, Aspro, Abramis, Scardinius* — Ciurea (1924, 28, 29, 33, 34). Europe, N. America.

A. imperator Lyster, 1940, in cats and pigeons (exper.); Canada. Also in *Ardea herodias, Mergus merganser, Lophodytes.*

Cercaria develops in *Amnicola, Helisoma, Complecta*, encysts in *Salvelinus, Salmo, Perca, Catostomus*, causing "black spot disease" — Miller, 1940.

A. major Szidat, 1924, syn. of *A. muehlingi* — Witenberg (1929), in *Larus fuscus*; Europe.

Apophallinae Ciurea, 1924

Subfamily diagnosis. — See p. 702.

Key to genera of Apophallinae from mammals

Oral sucker very large; esophagus shorter than pre-pharynx; testes juxtaposed; vitellaria not extending posterior to testes ..... *Pricetrema*

Oral sucker rather small, esophagus longer than prepharynx; testes diagonal; vitellaria extending posterior to testes ... *Apophallus*

Apophallus Lühe, 1909

Generic diagnosis. — See p. 702.

Genotype: *A. muehlingi* (Jägerskiöld, 1899) Lühe, 1909, syn. *Tocotrema muehlingi* (J.) Looss, 1899, in *Larus ridibundus;* Pillau. Also in dog, cat, *Larus argentatus cachinnans, L. ridibundus, Pelecanus onocrotalus, Himantopus himantopus, Cancroma cohlearia, Phalacrocorax pigmaeus, Colymbus septentrionalis;* Europe (Rumania, Poland).

Metacercaria encysted in flesh and fins of cyprinids, especially *Abamis brama, Leuciscus rutilus, Perca fluviatilis, Blicca björkna, Scardinius erythrophthalmus*, etc. — Ciurea (1930, 1933), Prettenhoffer (1930).

Representatives from mammals:

A. donicus (Skrjab. et Lindtrop, 1919) Price, 1931 (Pl. 94, Fig. 1127), in *Canis familiaris, Felis domestica, Vulpes lagopus* and *Phoca vitulina*. Also in rat and rabbit, *Buteo buteo, Asio otas, Ciconia ciconia, Mergus merganser, Nycticorax nycticorax, Larus ridibundus, Sterna cantiaca, Turtur communis, Columba livia;* Europe, U.S.A., Canada.

Metacercaria in *Perca fluviatilis, Acerina cernua, Blicca, Aspro, Abramis, Lucioperca, Scardinius* — Ciurea (1933), in *Perca fluviatilis, Acerina cernua, Scardinius erythrophthalmus, Gobio fluviatilis, Lucioperca sandra;* Balatonsee; adult experimentally in domestic duck and mice — Mödlinger (1934). Flame cell formula worked out by Hsü (1935).

A. eccentricus Africa et Garcia, 1935 in dog; Philippines.

A. imperator Lyster, 1940, in cats and pigeons (exper.); Canada. Intermediate host: *Salmo irideus, Salvelinus fontinalis*. Black spot disease — Miller (1940) (*Amnicola limosa, pigeon*, kittens experim.).

A. itascensis Warren, 1953, (metacercaria), in *Perca flavescens;* Minnesota.

A. similis (Ransom, 1920) (syn. *Cotylophallus s.* R.), syn. of *A. donicus* — Witenberg (1929), Price (1931); in *Phoca vitulina;* U.S.A.

A. venustus (Ransom, 1920) (syn. *Cotylophallus v.* R.), syn. of *A. donicus* — Witenberg (1929), Price (1931); in *Vulpes lagopus*, dog, cat, *Procyon lotor;* U.S.A., Canada. See p. 703.

Oculate lophocercous cercaria develops in *Goniobasis livescens;* metacercaria in cat fish, adult in cats, dogs, *Procyon lotor* and *Ardea herodias herodias* — Cameron (1926); metacercaria also in *Lepidosteus osseus, Catostomus commersonii, Luxilus cornutus, Cyprinus carpio, Amia calva, Ictalurus punctatus* — Cameron (1937); adult also in *Vulpes lagopus, Phoca vitulina* — Cameron (1945).

Таблица для определения видов рода *Apophallus* Lühe, 1909

1 (10). Желточники не заходят вперед за уровень брюшной присоски.
2 (7). Желточники не смыкаются позади семенников.
3 (6). Желточники заходят за семенники.
4 (5). Бифуркация кишечника на середине второй трети тела . . . . . *A. imperator* Lyster, 1940.
5 (4). Бифуркация кишечника в конце первой трети тела . . . . . *A. mühlingi* (Jägerskiöld, 1899)
6 (3). Желточники не заходят за семенники, бифуркация кишечника на расстоянии $^{2}/_{5}$ длины тела . . . *A. bacolloti* (Balozet et Callot, 1939).
7 (2). Желточники смыкаются позади семенников.
8 (9). Бифуркация кишечника около половины длины тела . . . . . *A. americanus* Van Cleave et Mueller, 1932.
9 (8). Бифуркация кишечника на расстоянии $^{1}/_{5}$ длины тела . . . . . *A. crami* Price, 1931.
10 (1). Желточники простираются вперед немного дальше брюшной присоски . . . . . *A. brevis* Ransom, 1920.

Genus APOPHALLUS Lühe, 1909

Synonyms.—Rossicotrema Skrjabin and Lindtrop, 1919; *Cotylophallus* Ransom, 1920.

Generic diagnosis.—Heterophyidae: Body ovoid to very elongated in shape. Prepharynx short; esophagus long; intestinal bifurcation usually nearer to acetabulum than to oral sucker; intestinal ceca slender, terminating as in *Cryptocotyle*. Acetabulum relatively well

developed, opening into a small, nonmuscular genital sinus; genital ducts open into genital sinus at base of two papilliform gonotyls; genital pore cephalad of acetabulum. Seminal vesicle well developed, **C** or **S** shaped, dorsal to uterine coils. Testes ovoid or globular, situated near posterior end of body, the right testis usually behind left. Ovary ovoid or globular, situated to right of median line cephalad of seminal receptacle. Vitellaria fill post-testicular space and extend usually to acetabulum or beyond. Uterus as in *Cryptocotyle*.

Type species.—Apophallus mühlingi (Jägerskiöld, 1899) Lühe, 1909.

KEY TO SPECIES OF APOPHALLUS

1. Body elongated, with more or less distinct constriction between acetabulum and bifurcation of intestine 2
   Body ovoid or elongated piriform in shape 3
2. Vitellaria extend to level of acetabulum; intestinal bifurcation about one-third of body length from anterior end ..... mühlingi
   Vitellaria do not extend anteriorly as far as acetabulum; intestinal bifurcation about one-fifth of body length from anterior end ..... crami
3. Body ovoid in shape; vitellaria extend to level of intestinal bifurcation or slightly beyond ..... donicum
   Body elongated piriform in shape; vitellaria extend only slightly beyond acetabulum ..... brevis

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APOPHALLUS AND RELATED GENERA

The species that have been assigned to the genus *Apophallus* by previous writers are as follows: *Apophallus mühlingi* (Jägerskiöld, 1899), Lühe, 1909 (type of genus), *A. brevis* Ransom, 1920, and *A. major* Szidat, 1924. According to Witenberg (1929), *A. major* is a synonym of *A. mühlingi* and *A. brevis* a synonym of *Rossicotrema donicum* Skrjabin and Lindtrop, 1919. The writer has reexamined the type specimens of *A. brevis* and feels that it should be regarded as a distinct species, at least until more material is available for study. According to the writer's conception of the genus it stands closer to *A. mühlingi* than to *R. donicum*.

In a recent paper, Witenberg (1930) states that "after restudying the available material of the genera *Rossicotrema*, Skrjabin, and *Tocotrema* (Looss), I concluded that they shall not be regarded as distinct ones, as they are presented in my paper. The differences between their representatives are rather of specific value, not greater than say between *Parascocotyle longa* (Ransom) and any other species of the genus *Parascocotyle*, i. e., in the number of gonotyls. I therefore find it suitable to regard the genus *Rossicotrema* as synonym of *Tocotrema*." In view of this statement the writer has examined the available material of the species of *Rossicotrema* and related genera, but can not concur in Witenberg's conclusion. A brief review of the case shows the following situation:

Ransom (1920) recognized the genus *Cryptocotyle* Lühe as valid and *Tocotrema* Looss as a synonym and stated: "Looss (1899b) took *lingua* as type of the genus *Tocotrema*, but its characters are so similar to those of the type of *Cryptocotyle* (*C. concava*) that the two can not be separated generically." On the contrary, Witenberg (1929) states: "In the species designated as types for *Cryptocotyle* and *Tocotrema* essential differences exist in the arrangement of the testes and in the shape of the body, both these characters being correlated. Thus, these two species can not be retained in one genus but must be separated; i. e., both *Cryptocotyle* and *Tocotrema* should be considered valid." The generic name *Ciureana* Skrjabin, 1923, is made a synonym of *Cryptocotyle*. Africa (1929) found considerable variation in the position of the testes in a small number of specimens of *C. lingua* and noted that out of ten specimens two showed the testes opposed as in *C. concava* and the others varied from this type to that described for *C. lingua*, and he states: "It seems that there is a wide range of variation both as to shape and position in the same species of the hitherto believed to be fixed structures." The writer has examined a number of specimens of species of *Cryptocotyle* and of the related genus *Rossicotrema* and is convinced that the "arrangement of the testes" and the "shape of the body"

are correlated characters but not characters of generic value. In specimens of *C. lingua* some were found in which the body was ovoid or piriform in shape and the testes opposite each other, while in others from the same lot these characters conform to the usual type, that is, body linguiform in shape and the testes placed obliquely to the long axis. The same variations were observed in specimens of *Rossicotrema donicum*. From these observations it is the writer's opinion that the position of the testes in the Heterophyidae, and possibly also in members of some of the other families, depends upon the shape of the body, and both body shape and position of testes depend upon the state of contraction of the specimens when killed.

It is frequently difficult to decide upon the relative value of characters and to determine which are of generic and which are of specific value. This is especially true with respect to the trematodes. In checking over the characters as given for the genera *Cryptocotyle* Lühe, *Tocotrema* Looss, *Ciureana* Skrjabin, *Rossicotrema* Skrjabin and Lindtrop, and *Apophallus* Lühe, only one character appears sufficiently constant to be of generic value, namely, the genital sinus and the arrangement of its accessory structures. In the first three of these genera the genital sinus is a spacious, somewhat muscular structure; the acetabulum is greatly reduced and situated in the anterior wall of the sinus; the genital aperture is postacetabular; and the genital ducts open into the sinus caudad of the acetabulum at the base of a single, papillalike gonotyl. In the genera *Rossicotrema* (syn. *Cotylophallus*) and *Apophallus* this arrangement is entirely different. The genital sinus is reduced in size and its walls weakly developed; the acetabulum is relatively strongly developed and opens into the sinus caudad of the genital pore; the genital ducts open into the sinus cephalad of the acetabulum and two papillalike gonotyls are present. Other characters are similar in members of these genera and such variations as are present are regarded as of specific value. It is the opinion of the writer, therefore, that all the above-named genera should be reduced to two, namely, *Cryptocotyle* (syns. *Tocotrema* and *Ciureana*) and *Apophallus* (syns. *Rossicotrema* and *Cotylophallus*). To the first of these genera, *Cryptocotyle*, the following species are referred: *C. concava* (Creplin), *C. lingua* (Creplin), *C. jejuna* (Nicoll), *C. quinqueangulare* (Skrjabin), *C. cryptocotyloides* (Issaichikoff), and *C. echinata* (von Linstow); and to the second genus, *Apophallus*, the following species: *A. mühlingi* (Jägerskiöld), *A. donicum* (Skrjabin and Lindtrop) (syns. *C. venustus* and *C. similis*), *A. brevis* Ransom, and *A. crami*, new species.

Genus APOPHALLUS Lühe, 1909

Synonyms.—*Rossicotrema* Skrjabin and Lindtrop, 1919, p. 40; *Cotylophallus* Ransom, 1920, p. 529.

Generic diagnosis.—Heterophyidae: Body ovoid to very elongated in shape. Prepharynx short; esophagus long; intestinal bifurcation usually nearer to acetabulum than to oral sucker; intestinal ceca slender, terminating as in *Cryptocotyle*. Acetabulum relatively well developed, opening into a small, nonmuscular genital sinus; genital ducts open into sinus at the base of two papilliform gonotyls; genital aperture cephalad of acetabulum. Seminal vesicle well developed, **C** or **S** shaped, dorsal to uterine coils. Testes ovoid or globular, situated near posterior end of body, the right usually behind left. Ovary ovoid or globular, situated to right of median line cephalad of seminal receptacle. Vitellaria fill posttesticular space and extend usually to acetabulum or beyond. Uterus as in *Cryptocotyle*.

Type species.—*Apophallus mühlingi* (Jägerskiöld, 1899) Lühe, 1909.

KEY TO SPECIES OF THE GENUS APOPHALLUS OCCURRING IN MARINE MAMMALS

1. Esophagus longer than prepharynx; seminal vesicle slender, **S** shaped; vitelline follicles relatively small, not extending anteriorly as far as pharynx ..... donicus (p. 36).
   Esophagus shorter than prepharynx; seminal vesicle wide, **C** shaped; vitelline follicles relatively large, extending to level of pharynx ..... zalophi (p. 36).

A. tubarium (Rud., 1819) Poche 1926
Syn. Dist. tubarium
Dist. fuscescens

[This is the genus Cotylophallus Ransom, 1920]

Apophallus muehlingi (Jagerskiold 1899) Heterophyidae

Apophallus muhlingi

A single individual was recovered from the first fifth intestine of an adult *LR* taken at Bingley, GREAT BRITAIN
LARUS RIDIBUNDUS

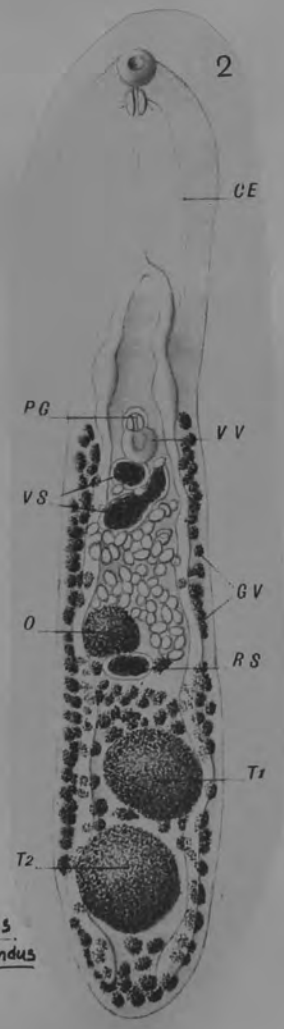
No previous British records.

Description (Fig. 1, Ventral view): Specimen 2·33 × 0·48 mm. Body elongate, slightly constricted at level of ventral sucker and ovary. Marked cuticular spination anteriorly, where spines occur in well defined rows, but few present at extreme posterior end.

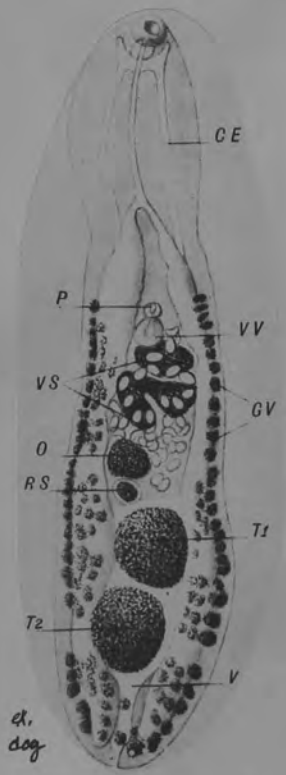
Suckers small and sub-equal; ventral situated near mid-region. Oral 0·07 × 0·05 mm., ventral 0·08 × 0·07 mm. Prepharynx short, 0·03 mm. in length. Pharynx small, 0·10 mm. in length. Bifurcation of oesophagus 0·51 mm. from anterior extremity. Sacciform caeca extend to posterior extremity. Genital pore immediately in front of ventral sucker. Genital atrium deep and flask-shaped. Cirrus pouch absent, seminal vesicle prominent. Rounded testes lie in tandem, anterior 0·31 × 0·26 mm., posterior 0·35 × 0·29 mm. Ovary, 0·22 × 0·19 mm., immediately in front of anterior testis. Uterus short with few folds. Follicular vitellaria extend laterally behind ventral sucker and merge mesially between testes in posterior region. Eggs 0·038 × 0·024 mm.

FROM PEMBERTON, 1963

FROM ODENING, 1964
HOST: Larus r. ridibundus



cf. Larus ridibundus



From: Ciurea (1924)

Apophallus mühlingi (Jägerskiöld, 1899) Lühe, 1909

Синонимы: *Distomum mühlingi* Jägerskiöld, 1899; *Apophallus major* Szidat, 1924; *Distoma lingua* of Mühling, 1898; *Metorchis oesophagolongus* Katsuta, 1914; *Tocotrema mühlingi* (Jägerskiöld, 1899) Looss, 1899

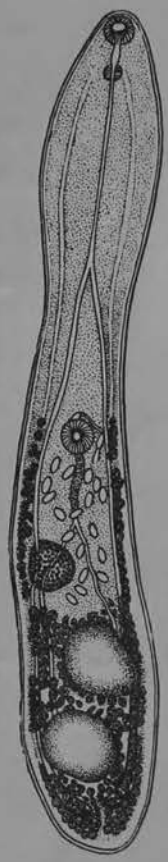
(Рис. 71)

Дефинитивные хозяева: кошка (*Felis catus domesticus*), собака (*Canis familiaris*); птицы: *Buteo buteo, Pelecanus onocrotalus, P. crispus, Phalacrocorax carbo, Ph. pygmaeus, Ciconia ciconia* (экспериментально), *Larus ridibundus, L. argentatus cocninnaus, L. canus, L. fuscus, Sterna cantiaca, Colymbus septentrionalis, Himantopus himantopus, Cohlearius cohlearius, Ardea cinerea, Egretta gorsetta.*

Дополнительные хозяева: рыбы — *Blicca bjorcna, Acarina cernua, Abramis brama, Leuciscus rutilus, Idus idus, Abramis ballerus, A. sapa, Scardinius erithrophthalmus.*

Локализация: взрослые — в кишечнике окончательного хозяина, метацеркарии — в тканях рыб.

Места обнаружения: Европа, Азия.



71

Apophallus americanus Van Cleave et Mueller, 1932

(Рис. 74)

Дефинитивные хозяева: рыбы — *Stizostegion vitreum*, *Perca flavescens*, рыбоядные птицы и млекопитающие.

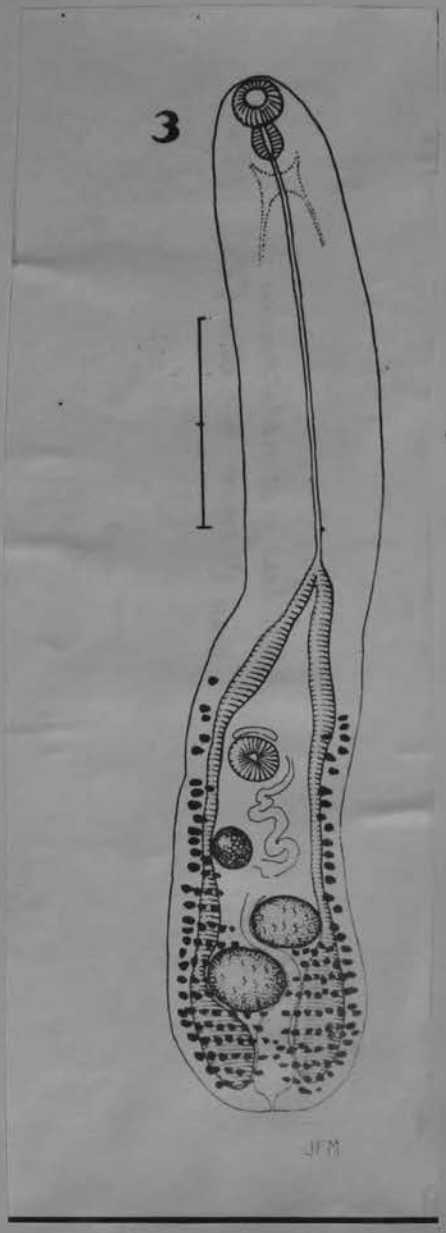
Дополнительный хозяин: пескарь (*Gobio* sp.).

Локализация: кишечник.

74

Apophallus americanus VanCleave & Mueller, 1932

Hosts: Stizostedion vitreum; Perca flavescens (perhaps accidental)

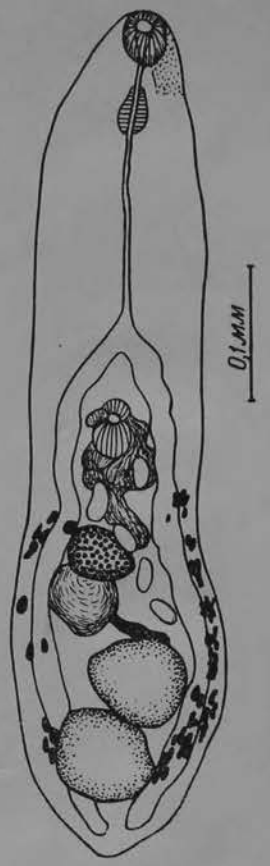


Apophallus bacolloti (Balozet et Callot, 1939) Morosov, 1952

Синоним: *Apophallus* sp. Balozet et Callot, 1939

(Рис. 76)

Дефинитивный хозяин: *Botaurus stellaris*.
Дополнительные и промежуточные хозяева неизвестны.
Локализация: кишечник.
Место обнаружения: Тунис.
Историческая справка. *Apophallus bacolloti* был описан в 1939 г. Балозе и Калло (Balozet et Callot, 1939) под названием *Apophallus* sp.
Сравнив описание и рисунок этого вида с описанием и рисунками других видов рода *Apophallus*, мы пришли к выводу, что это самостоятель-



76

Apophallus brevis Ransom, 1920

(Рис. 72)

Дефинитивный хозяин: *Larus delavarensis*.

Дополнительный хозяин: рыбы.

Промежуточный хозяин: *Amnicola limosa*.

Локализация: взрослые — в кишечнике окончательного хозяина.

Место обнаружения: Америка.

Историческая справка. Витенберг (1929) установил, что *A. brevis* является синонимом *Rossicotrema donicum* Skrjabin et Lindtrop, 1919, но Прайс (1931), проводя ревизию рода *Apophallus*, оставляет этот вид самостоятельным, не соглашаясь с Витенбергом.

Листер (1940) снова проводит ревизию рода *Apophallus* и также сохраняет самостоятельность вида *A. brevis*.

Миллер (Miller, 1941) описывает церкария *A. brevis*.

Мы считаем, что отличительных признаков у *A. brevis* вполне достаточно для того, чтобы признавать его самостоятельным видом.

Описание вида (по Рансому, 1920). Тело удлиненное, расширенное в задней части и суженное в передней, 0,6—0,9 мм длины и 0,12—0,26 мм ширины. Кутикула покрыта шипиками 0,004 мм длины. Ротовая присоска округлая, маленькая, 0,030—0,050 мм в диаметре. Имеется короткий префаринкс и очень маленький фаринкс. Пищевод тонкий, длинный; бифуркация кишечника в конце первой трети тела. Кишечные ветви тянутся до заднего конца тела. Брюшная присоска 0,035—0,055 мм в диаметре, располагается медиально около середины длины тела. Семенники неправильно поперечно-овальные, лежат наискось, правый семенник позади левого, поперечный диаметр правого семенника 0,045—0,145 мм, продольный диаметр 0,045—0,120 мм. Он отстоит от заднего конца тела на расстоянии своего продольного диаметра. Яичник шаровидный или овальный, 0,050—0,080 мм в поперечном диаметре и 0,060—0,090 мм в продольном диаметре, лежит в правой стороне, приблизительно на середине расстояния между брюшной присоской и передним семенником. Семяприемник лежит непосредственно позади яичника, шаровидный, 0,040—0,080 мм в диаметре. Желточники начинаются на уровне переднего края брюшной присоски и идут до заднего конца тела, заполняя все пространство позади семенников, вклиниваясь и между семенниками. Поперечный желточный проток проходит позади яичника и впереди левого — переднего — семенника. Яйца 0,036—0,040×0,016—0,022 мм.

A. brevis дифференцируется от *A. mühlingi* своим меньшим размером, более крупными яйцами, очень маленькими размерами ротовой присоски и фаринкса, формой семенников и расположением желточников.

Церкарий типа *Pleurolophocercus* описан Миллером в 1941 г. из моллюска *Amnicola limosa*. Тело в передней части покрыто мелкими

72

A NEW SPECIES OF TREMATODE OF THE FAMILY HETEROPHYIDAE, WITH A NOTE ON THE GENUS APOPHALLUS AND RELATED GENERA

By EMMETT W. PRICE

Parasitologist, Zoological Division, Bureau of Animal Industry, United States Department of Agriculture

During the summer of 1929, Dr. Eloise B. Cram, of the Zoological Division, Bureau of Animal Industry, conducted an investigation in cooperation with representatives of the Bureau of Biological Survey to determine if parasites were a factor in causing the death of ducks from the so-called "duck disease" at Klamath Falls, Oreg. Among the specimens of parasites collected from water birds in this vicinity were a number of trematodes, one species of which appears to be new. This fluke belongs to the family Heterophyidae Odhner, 1914, and to the genus *Apophallus* Lühe, 1909. For this trematode the name *Apophallus crami* is proposed, the species being named for the collector.

FIGURE 1.—*Apophallus crami*, new species. Ventral view

APOPHALLUS CRAMI, new species Price, 1931

FIGURE 1

Specific diagnosis.—Apophallus: Body slender, 1.5 mm. to 1.9 mm. long by 279μ to 341μ wide in the vicinity of the testes; preacetabular portion of body flattened and showing a slight constriction in the region between the acetabulum and the intestinal bifurcation; postacetabular portion more or less cylindrical. The cuticle is covered with small scalelike spines. Oral sucker subterminal, 45μ to 60μ in diameter; prepharynx very short; pharynx ovoid, 45μ long by 30μ wide. Esophagus slender, about 337μ long, bifurcating about one-fifth of the body length from the anterior end; intestinal ceca slender, extending to near the posterior end of the body. Acetabulum 52μ to 62μ in diameter, situated at the equator of the body and opening into the genital sinus. Genital pore at anterior end of genital sinus, the aperture being guarded by two ovoid, papillalike gonotyls. Testes globular or slightly ovid in shape and placed obliquely in the posterior fourth of the body, the right caudad of the left. The left testis is 180μ to 187μ in diameter and the right 150μ to 160μ long by 187μ to 210μ wide. Seminal vesicle well developed, S-shaped, and situated in the median line caudad of the acetabulum. Ovary globular or slightly ovoid in shape, 75μ to 97μ in greatest diameter, situated a short distance in front of the anterior testis and to the right of the median line. Seminal receptacle ovoid, 50μ to 67μ long by 60μ to 82μ wide, and situated immediately caudad of the ovary. The vitellaria are composed of relatively large follicles, which extend anteriorly to about 150μ to 155μ caudad of acetabulum; posteriorly they extend to the posterior end of the body and almost completely fill the post-testicular space. Uterus with relatively few loops and confined to the intercecal space between ovary and acetabulum. Eggs ovoid, 33μ long by 25μ wide, with yellowish-brown shells.

Host.—California gull (*Larus californicus*).

Location.—Lower part of small intestine.

Distribution.—United States (Klamath Falls, Oreg.).

Type specimen.—U.S.N.M. Helm. Coll. No. 29245; paratypes No. 29779.

NO. 2883.—PROCEEDINGS U. S. NATIONAL MUSEUM, VOL. 79, ART. 17

59431—31

Remarks.—Apophallus crami resembles *A. mühlingi* (Jägerskiöld) more closely than it does any of the other species of the genus, the principal difference between the two being in the extent of the vitellaria anteriorly. In *A. mühlingi* the vitellaria extend anteriorly to the level of the acetabulum, while in *A. crami* they stop abruptly at or near the level of the posterior end of the seminal vesicle. Other minor differences exist, but they are not regarded as being of particular specific value. The distribution of the vitellaria appears to be a constant character in members of the genus. In the species described in this paper, about 100 specimens were examined, and the variation as regards this character was found to be insignificant. In one specimen the vitelline follicles on the left side were found to extend as far anterior as the acetabulum, but on the right side they did not extend beyond the posterior margin of the seminal receptacle. This specimen was clearly an anomalous one and of no significance so far as the constancy of the distribution of the vitellaria is concerned.

Heterophyidae

APOPHALLUS CRAMI, ~~new species~~ PRICE, 1931

FIGURE 1

Specific diagnosis.—Apophallus: Body slender, 1.5 mm. to 1.9 mm. long by 279μ to 341μ wide in the vicinity of the testes; preacetabular portion of body flattened and showing a slight constriction in the region between the acetabulum and the intestinal bifurcation; postacetabular portion more or less cylindrical. The cuticle is covered with small scalelike spines. Oral sucker subterminal, 45μ to 60μ in diameter; prepharynx very short; pharynx ovoid, 45μ long by 30μ wide. Esophagus slender, about 337μ long, bifurcating about one-fifth of the body length from the anterior end; intestinal ceca slender, extending to near the posterior end of the body. Acetabulum 52μ to 62μ in diameter, situated at the equator of the body and opening into the genital sinus. Genital pore at anterior end of genital sinus, the aperture being guarded by two ovoid, papillalike gonotyls. Testes globular or slightly ovid in shape and placed obliquely in the posterior fourth of the body, the right caudad of the left. The left testis is 180μ to 187μ in diameter and the right 150μ to 160μ long by 187μ to 210μ wide. Seminal vesicle well developed, S-shaped, and situated in the median line caudad of the acetabulum. Ovary globular or slightly ovoid in shape, 75μ to 97μ in greatest diameter, situated a short distance in front of the anterior testis and to the right of the median line. Seminal receptacle ovoid, 50μ to 67μ long by 60μ to 82μ wide, and situated immediately caudad of the ovary. The vitellaria are composed of relatively large follicles, which extend anteriorly to about 150μ to 155μ caudad of acetabulum; posteriorly they extend to the posterior end of the body and almost completely fill the post-testicular space. Uterus with relatively few loops and confined to the intercecal space between ovary and acetabulum. Eggs ovoid, 33μ long by 25μ wide, with yellowish-brown shells.

Host.—California gull (*Larus californicus*).

Location.—Lower part of small intestine.

Distribution.—United States (Klamath Falls, Oreg.).

Type specimen.—U.S.N.M. Helm. Coll. No. 29245; paratypes No. 29779.

Comparisons: A. mühlingi (Jägerskiöld)

Reference: Proc. of U.S. Nat. Museum, 79(17):1-6

Apophallus crami Price, 1931

(Рис. 73)

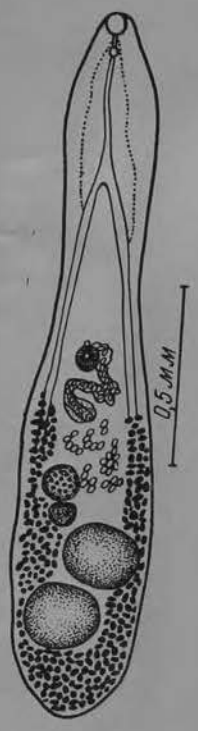
Дефинитивный хозяин: *Larus californicus*.

Дополнительный и промежуточный хозяева: неизвестны.

Локализация: тонкие кишки.

Место обнаружения: США.

Описание вида (по Прайсу, 1931). Тело продолговатое, 1,5—1,9 мм длины и 0,279—0,341 мм ширины на уровне семенников. Передняя часть тела до брюшной присоски уплощена, с небольшим вдавлением между брюшной присоской и бифуркацией кишечника. Задняя часть за брюшной присоской более или менее цилиндрическая. Ротовая присоска субтерминальная, 0,045—0,060 мм в диаметре. Префаринкс очень короткий. Фаринкс овальный, 0,045 мм длины и 0,030 мм ширины. Пищевод тонкий, около 0,337 мм длины, бифуркация кишечника приблизительно на расстоянии $^1/_5$ части длины тела от переднего конца. Кишечные ветви тонкие, тянутся почти до заднего края тела. Брюшная присоска 0,052—0,062 мм в диаметре, располагается в экваториальной части тела и открывается в генитальный синус. Половое отверстие в передней части генитального синуса. Оно защищено двумя сосочкообразными гонотилями, расположенными по бокам его. Семенники шаровидные или слегка овальные и расположены наискось в задней четверти тела, правый позади левого. Левый семенник 0,180—0,187 мм в диаметре, правый 0,150—0,160 мм длины и 0,187—0,200 мм ширины. Семенной пузырек хорошо развит, S-образный



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APOPHALLUS DONICUS (Skrjabin and Lindtrop, 1919) Price, 1931

PLATE 9, FIGURE 37

Synonyms.—Rossicotrema donicum Skrjabin and Lindtrop, 1919, pp. 41–42; *R. simile* (Ransom, 1920) Ciurea, 1924, p. 14; *Cotylophallus venustus* Ransom, 1920, p. 555; *C. similis* Ransom, 1920, p. 555.

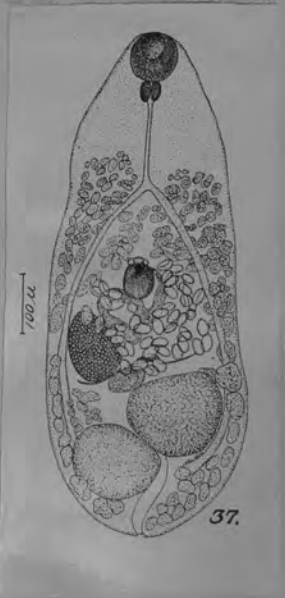
Description.—Apophallus: Body ovoid to linguiform in shape, 500μ to 1.14 mm long by 200μ to 390μ wide. Cuticular scalelike spines 4μ to 7.5μ long by 1.5μ to 3μ wide. Oral sucker 65μ to 85μ in diameter; prepharynx very short; pharynx 30μ to 44μ in diameter; esophagus slender, bifurcating 135μ to 265μ from the anterior end of body; intestinal ceca simple, extending into posterior fourth of body. Acetabulum 45μ to 58μ long by 48μ to 60μ wide, situated 185μ to 560μ from the anterior end of body. Testes oval or globular in shape, 80μ to 200μ by 60μ to 200μ, situated obliquely in extended specimens, more or less opposed in more contracted specimens, and occupying the posterior third of the body. Ovary 65μ to 140μ by 40μ to 120μ, situated 200μ to 750μ from the anterior end of body. Seminal receptacle 60μ to 130μ wide by 35μ to 90μ long, situated between the posteromedian border of the ovary and the anteromedian border of the left testis. Vitellaria well developed, extending from posterior end of body to slightly beyond the bifurcation of the ceca. Uterus with few coils and occupying the intercecal space between anterior border of the left testis and the anterior margin of acetabulum. Eggs 30μ to 35μ long by 16μ to 20μ wide.

Hosts.—Canis familiaris, *Felis domestica*, *Vulpes lagopus*, and *Phoca vitulina*.

Location.—Small intestine.

Distribution.—Europe and North America (United States).

Remarks.—This description is taken from that of Ransom (1920) for *Cotylophallus similis*, the specimens (U.S.N.M. Helm. Coll. No. 4279) upon which the description was based having been collected from the harbor seal by Dr. Albert Hassall, in Washington, D. C., December 21, 1905. The writer has compared these specimens with specimens from dogs and cats and agrees with Witenberg (1929) that there is no reason for regarding this form as a species distinct from *A. donicus* (= *R. donicum*).



Apophallus donicus (Skrjabin and Lindtrop, 1919) Price, 1931

Measurements and some pertinent data (based on one adult worm) : Body 445 long by 177 wide, spined to testicular level; forebody 205 long, hindbody 200 long, forebody-hindbody length ratio 1 : 0·98 ; oral sucker 29 by 37 ; acetabulum 35 by 33 ; sucker length ratio 1 : 1·17, width ratio 1 : 0·89 ; prepharynx absent ; pharynx 28 by 29 ; oesophagus 87 long ; caecal bifurcation 54 preacetabular ; caeca conspicuously cell lined ; anterior testis dextral, 59 by 68, lying 59 postacetabular ; posterior testis sinistral, contiguous with anterior testis, 65 by 68, lying 92 postacetabular ; posttesticular space 44 long ; ovary sinistral, 45 by 55, lying 12 postacetabular, separated from anterior testis by seminal receptacle ; latter 52 by 74 ; vitelline fields continuous, not confluent posteriorly, confluent from short distance preacetabular to level of posterior part of oesophagus ; uterine coils few between anterior testis and acetabulum, containing 21 eggs ; five eggs measuring 28–31 (30) by 12–16 (15).

Host : *Gorsachius melanolophus rufolineatus* Hachisuka, tiger bittern (Ciconiiformes : Ardeidae).

Location : Small intestine.

Locality : Tarabanan Concepción.

Date : 13 May 1962.

Specimen : No. 72203.

Discussion : Our specimen is much smaller in body length than previously recorded for this species and its synonyms, and probably is a young adult.

From Freitthal, 1992

Apophallus imperator Lyster, 1940

(Рис. 75)

Дефинитивные хозяева: млекопитающие — кошка (*Felis catus domesticus*); птицы — *Ardea herodias, Mergus merganser, Lophodites cucullatus, Strix vario.*

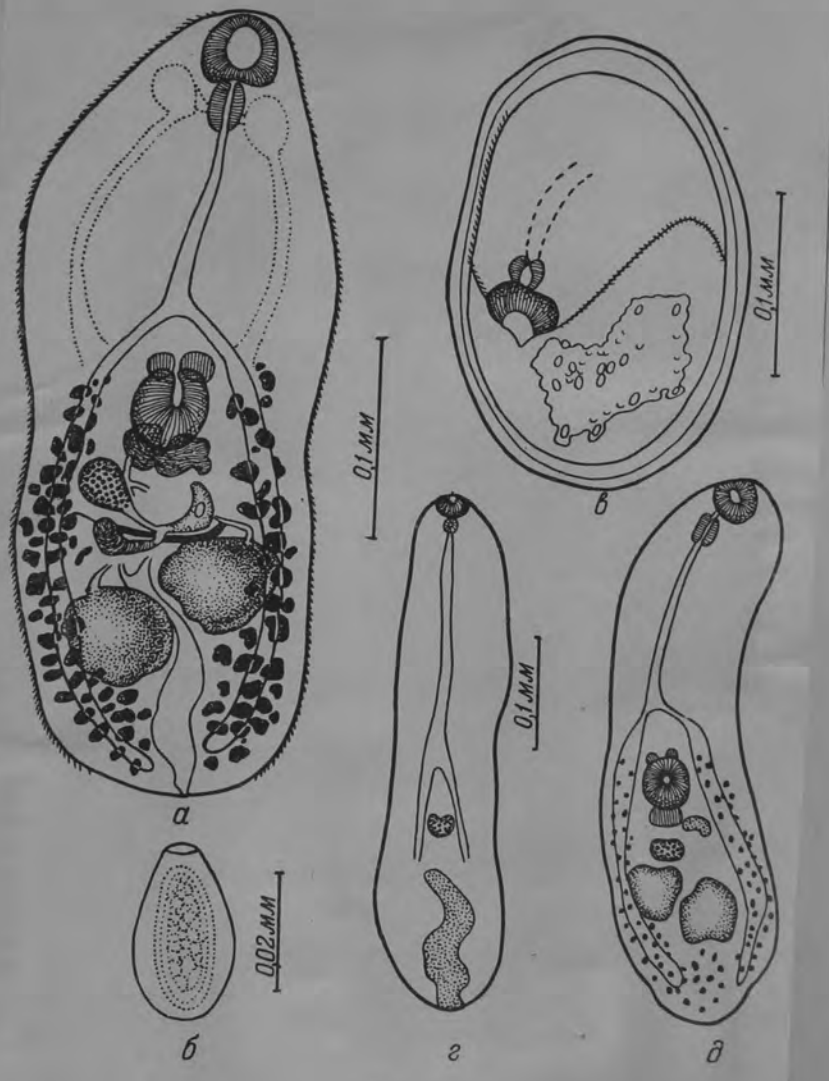
Дополнительные хозяева: *Salvolinus fintinalis, Perca flavescens, Cattostomus* sp.

Промежуточные хозяева: предположительно, моллюски родов *Amnicola, Helisoma, Complecta.*

Локализация: взрослые в кишечнике дефинитивного хозяина.

Место обнаружения: Канада.

Описание вида (по Листеру, 1940). Тело удлиненное, грушевидное, покрыто параллельными рядами шипов, которые очень много-



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75. *Apophallus imperator* Lyster, 1940 (по Листеру, 1940)

а — марита; *б* — яйцо; *в* — метацеркарий в цисте; *г*, *д* — метацеркарии, освобожденные от цисты

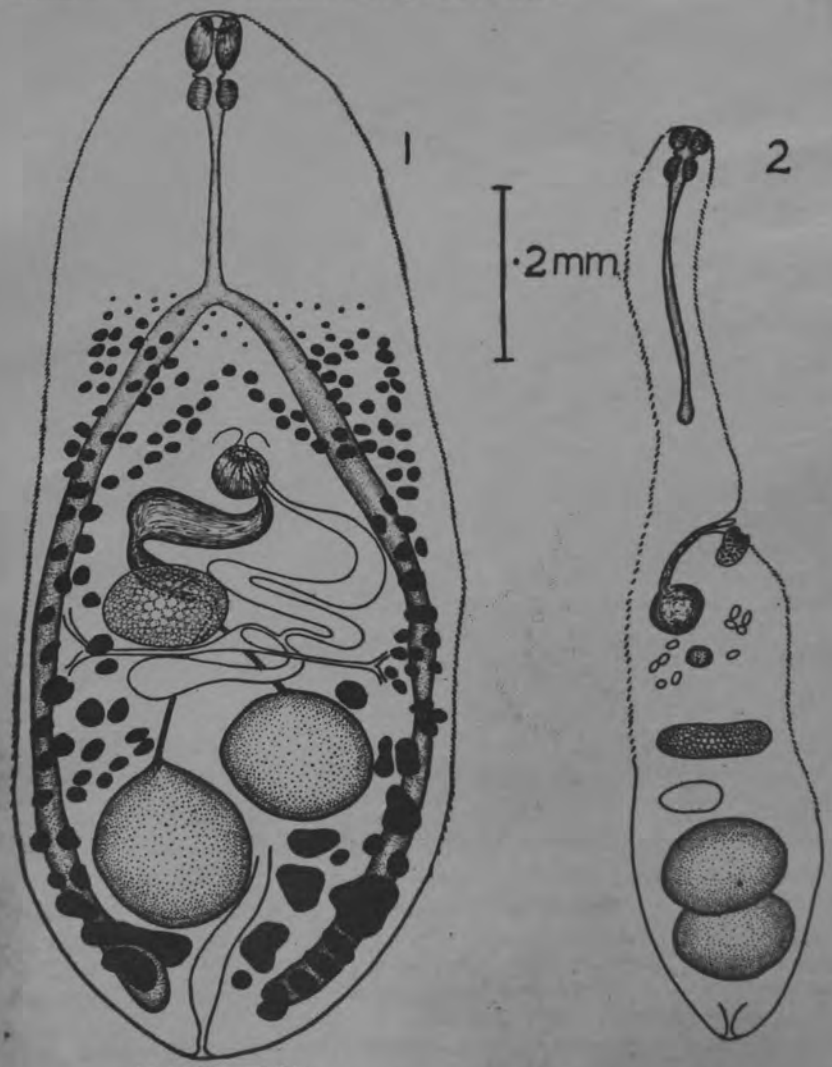
Heterophyidae

The contour of the body is elongated oval in most cases, being slightly broader at the posterior end (Fig. 1). In many cases however, it becomes narrower in the middle, resembling the sole of a child's shoe; in a few cases it is almost pyriform. These variations in outline are found in batches fixed, stained and mounted in bulk and so subjected to identical conditions of technique. It varies in length from 0.95 to 1.4 mm. and its maximum breadth is from 0.25 to 0.55 mm. The mean size is approximately 1.1 by 0.4 mm. The anterior half is only about half the thickness of the posterior half.

The cuticle is provided with numerous small spines in the anterior half. At the level of the genital pore they commence to decrease in number and the posterior quarter of the body is almost entirely free.

The oral sucker is slightly sub-terminal and ventral, and is oval in shape, measuring 0.07 mm. long by 0.06 mm. broad.

The ventral sucker is in the mid-line of the body just in front of the mid-point. It is slightly but distinctly muscular: in size, it is slightly smaller than the oral sucker (0.06 mm.). It is situated on the posterior margin of a genital sinus and is directed anteriorly. The genital openings occur at the base of the sinus, anterior to the ventral sucker, and from their antero-lateral margins arise two feebly muscular papillae (Figs. 1 and 2), the so-called genital papillae.



Apophallus venustus

FIG. 1. *Typical adult drawn from ventral aspect.*

FIG. 2. *Medial view of adult, reconstructed from serial sections.*

Digestive System

The oral sucker is connected by a small prepharynx to the muscular pharynx. The oesophagus is long and simple and gives rise to two intestinal caeca, a considerable distance in front of the genital sinus and about a quarter of the body length from the anterior end. The caeca run to the posterior end of the body, terminating almost in contact with the excretory vesicle.

Male Genital System

There are two almost spherical testes, situated obliquely to each other in the posterior region of the body; the right testis is generally posterior. They have a diameter of 0.15 to 0.2 mm. The vasa efferentia unite at about the level of and dorsal to the ovary. The vas deferens quickly becomes enlarged to form a conspicuous seminal vesicle, which is roughly S-shaped with a central constriction and lies between the ovary and the genital sinus. It is continued by an ejaculatory canal to open in the base of the genital sinus on the same side as the ovary. There is no cirrus.

Female Genital System

The ovary is transversely ellipsoidal, measuring 0.15 mm. by 0.1 mm., with a smooth contour, and is situated anterior to both testes, on the same side of the body as the posterior one. Behind the ovary and towards the dorsal surface of the body, is a transversely oval spermatheca. Lying mainly on the side of the body opposite to that on which lies the ovary, but encroaching on the ovarian side of the body as well, is a relatively short uterus of several loops. It terminates at the base of the genital sinus, by the side of the male canal. Laurer's canal is absent.

The yolk follicles are numerous small groups of cells which occupy the posterior part of the body. Their anterior limit is about level with the junction of the two intestinal caeca, and is remarkably constant in all the specimens examined. The anterior follicles, which cross the mid-line of the body, are smaller and more numerous than the posterior follicles (Fig. 1.). The posterior follicles pass behind the testes and occupy all the otherwise unoccupied space there. The yolk ducts originate about the middle of the yolk glands, between the spermatheca and the ovary and unite to form a common yolk reservoir of varying size in the mid-line.

The eggs are few in number (up to 100) and measure 26 to 32μ by 18 to 22μ.

Excretory System

The excretory system was not studied in detail. The excretory vesicle is Y-shaped with the posterior stem S-shaped in order to pass between the two testes. The excretory pore is terminal.

Nomenclature

The systematic position of the various species in this genus has given rise, in the past few years, to a considerable amount of discussion.

The genus *Apophallus* was created in 1909, by Lühe, for a species from *Larus ridibundus* from Central Europe which had been misidentified in 1898 by Creplin as *Distomum lingua*; and renamed *Distomum mühlingi* by Jägerskiöld the following year. In the same year, Looss placed it in the genus *Tocotrema* and it was not until 1909 that Lühe made it the type of his new genus with the name of *Apophallus mühlingi* (Jägerskiöld, 1899) Lühe, 1909.

In 1920, Ransom (9) described a new species from *Larus delawarensis* (from Washington, D.C.) under the name of *Apophallus brevis* and created a

new genus, *Cotylophallus* to receive two other new species, *viz:*— *C. similis* (from *Phoca vitulina* from Washington, D.C.) and *C. venustus* (from dogs, cats and *Vulpes lagopus* from the same area). These four species were separated from each other on the disposition of the yolk follicles.

Meanwhile, in 1919, Skrjabin and Lindtrop (10) created the genus *Rossicotrema* to receive the new species *R. donicum* from dogs and cats in Russia. This work was inaccessible to Ransom at the time of writing and there is little doubt that if he had known of it, he would not have created his genus *Cotylophallus* but would have included his species in the genus *Rossicotrema:* they were transferred to this genus by Ciurea in 1924.

In 1929, in a revision of the family, Witenberg (11), after examination of a cotype of *A. brevis* Ransom, concluded that it also should be included in the genus *Rossicotrema*. He considered however that no specific differences existed among the four species now included in the genus and he suppressed all Ransom's species as synonyms of *R. donicum*. However, he recognized the genus *Apophallus* as distinct from *Rossicotrema*, mainly on the basis of the disposition of the testes, which were tandem to each other in the former and oblique in the latter. He regarded the genus *Tocotrema* as closely related to *Rossicotrema*, differing from it mainly in the presence of a single gonotyle (a name he applied to the genital papillae in these genera and analogous structures in other genera in this family), instead of a pair.

In the following year (1930) however, as the result of re-studying the available material, he concluded that the number of gonotyles was a specific rather than a generic character and he suppressed *Rossicotrema* in favor of *Tocotrema* (12). However, previous workers had suppressed the genus *Tocotrema* in favor of *Cryptocotyle;* Witenberg disagreed with this and recognized both genera as valid. This view has not been generally accepted and is especially criticized by Stunkard in his paper on the life-cycle of *Cryptocotyle lingua*. Witenberg had separated these two genera on the basis of shape of body and disposition of testes. Stunkard (1930) argued that the genera *Cryptocotyle* and *Tocotrema* were congeneric. He examined hundreds of *C. lingua* (which Witenberg had placed in *Tocotrema*) and found a few were as short and broad as *C. concava* (the type of *Cryptocotyle*), although ordinarily the body was longer and narrower. In a few specimens also, the testes lay at the same level, although normally they were diagonal. In *C. concava* however, the testes were on opposite sides of the median plane whereas in *C. lingua* both testes extended across this plane. He regarded these differences as specific rather than generic and referred both species to *Cryptocotyle*.

Price (7), in 1931, in a discussion on these species, concluded that *Cryptocotyle* and *Apophallus* were valid genera, separated from each other mainly in the structure of the ventral-sucker–genital-opening complex. In *Cryptocotyle* the genital sinus is a spacious, somewhat muscular structure, the ventral sucker is greatly reduced and is situated in the anterior wall of the sinus; the genital openings are behind the ventral sucker and the ducts open at the base of a *single* papilla-like gonotyle. In this genus he included *Tocotrema* Looss,

1899, as well as two other genera (*Hallum* Wigdor, 1918, and *Ciureana* Skrjabin, 1923) which are not discussed in this paper.

In *Apophallus*, the genital sinus is reduced in size and its walls feebly developed, while the ventral sucker, which is relatively strongly developed, is on its posterior margin; the genital openings are in front of the ventral sucker and two papilla-like gonotyles are present. In this genus he included *Rossicotrema* and *Cotylophallus*.

Four species of *Apophallus* were recognized by Price, *viz*:—

Body elongated, with more or less distinct constriction between ventral sucker and bifurcation of oesophagus:

Yolk glands extend to level of ventral sucker; oesophageal bifurcation about one-third body length from anterior end . . *A. mühlingi* (type).

Yolk glands do not extend anteriorly as far as ventral sucker: oesophageal bifurcation about one-fifth of body length from anterior end . . . . . *A. crami* Price, 1931. (from *Larus californicus*, Oregon).

Body ovoid in shape; yolk glands extend to level of oesophageal bifurcation or slightly beyond . . . . . *A. donicum* (including *venustus* and *similis*).

Body elongated pyriform in shape; yolk glands extend only slightly beyond ventral sucker . . . . . *A. brevis*.

In the following year (1932) he described a new species, *Apophallus zalophi* from *Zalophus californianus* (8). This species is related to *A. donicus* but is smaller and thicker, has a much longer pre-pharynx and relatively large yolk follicles, which do not pass posterior to the anterior edge of the testes. There is, moreover, a greater tendency for the testes to be opposed. (Ciurea (6) (1933) has removed this species from the genus *Apophallus* to make it the type of a new genus, *Pricetrema*.)

Ciurea (1933) did not agree with Price in regarding the genus *Rossicotrema* as synonymous with *Apophallus*, believing the differences in the shape of the body, the situation of the testes and the development of the metacercaria, to be of generic importance.

Moreover, he did not regard *R. donicum* as being identical with *R. venustum* or *R. simile*. He believed all three species were valid and that they could be distinguished by the position of the anterior limit of the yolk glands. In *R. venustum*, these reach almost to the level of the bifurcation of the intestine; in *R. simile*, they pass this point, while in *R. donicum*, they do not reach it. The other species were left in *Apophallus*.

In 1935, Africa and Garcia (1) described *Apophallus eccentricus* from the dog in the Philippines. In this species, however, not only is the pre-pharynx long, but the genital pore is *lateral* instead of anterior, the yolk glands are considerably post-acetabular and the uterus extends to the posterior region of the body. This latter point alone seems sufficient to exclude it from this

We have to deal with one of four possible species, *R. donicum*, *A. brevis*, *C. venustus* and *C. similis*, which have been variously referred to three genera by modern authors, *viz*.:—

Witenberg (11, 12) (1929-1930) regards all four as synonymous and refers them all to the genus *Tocotrema* under the name of *T. donicum*.

Price (7) (1931) regards all four as belonging to the genus *Apophallus* considering the last two as synonymous with the first and so recognizing only two valid species, *A. donicus* and *A. brevis*.

In *A. donicus*, the body is ovoid and the yolk glands reach to the level of the oesophageal bifurcation, while in *A. brevis*, the body is pyriform with the yolk glands passing only slightly beyond the acetabulum.

Ciurea (6) (1933) regards all four as valid species and refers *A. brevis* to the genus *Apophallus* and the other three to the genus *Rossicotrema*. He separated these three species from each other as follows:

R. venustus—Yolk follicles reach almost to level of bifurcation of oesophagus.

R. simile—Yolk follicles pass in front of level of bifurcation of oesophagus.

R. donicum—Yolk follicles do not reach the level of bifurcation of oesophagus.

A considerable amount of this confusion is due to the fact that these three workers have adopted different generic criteria. Witenberg regards the relationship of the testes to each other as of fundamental importance; Price places emphasis on the anterior or posterior position of the ventral sucker relative to the genital openings; Ciurea considers not only the disposition of the testes, but the shape of the body and development of the trematode as important generic features, while considering the structure of the ventral-sucker–genital-sinus complex as of super-generic importance.

While Witenberg is possibly correct in regarding the presence of one or of two gonotyles as only of specific importance, it would seem that the opening of the genital ducts anterior or posterior to the ventral sucker is of very considerable importance, more so even than the relationship of the testes to each other. Accordingly, Price's criterion is accepted in this paper and *Tocotrema* regarded as a synonym of *Cryptocotyle*, and *Rossicotrema* as a synonym of *Apophallus*.

The question of species is much more difficult. There is a considerable similarity not only among the four "species" mentioned above, but among them and *A. crami* and *A. mühlingi*. They are differentiated on characters which appear to vary within wide limits.

Outline of Body

As mentioned above, the outline in most of my specimens is an elongated oval, somewhat more pointed at the anterior end than at the posterior, and slightly broader at the level of the testes than at the level of the oesophageal bifurcation. In a few cases, the body is markedly broader at the level of

between them (Fig. 3). The majority are ovoid however, and the two exceptions do not reach the limits shown in Price's drawing of *A. crami*, or Ransom's drawing of *A. brevis*. It may well be the case that all the specimens of these two species have constant body outlines, but the fact that this is not the case in the Canadian material greatly reduces the value of this feature as a specific character.

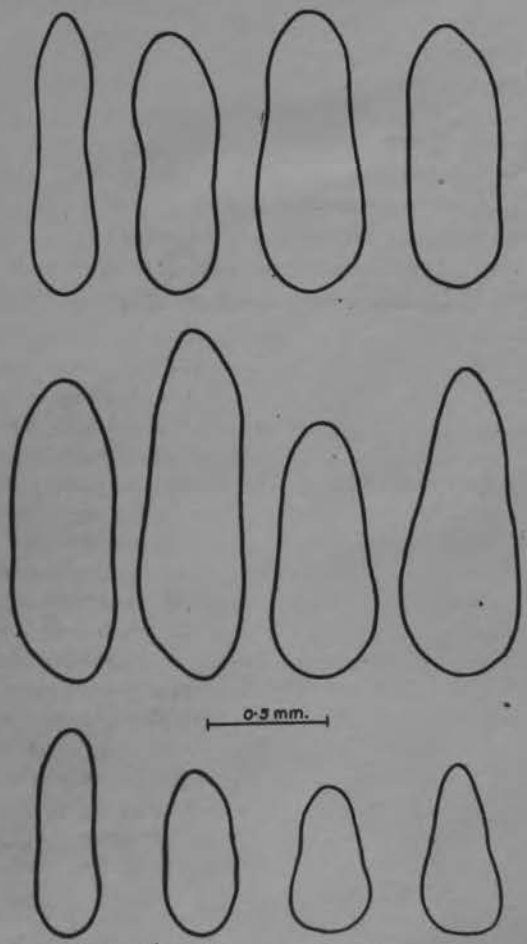


FIG. 3. *Camera lucida drawings, all to same scale, of A. venustus (upper two rows) and A. donicus (bottom row).*

Testes

In every case (except the obvious malformations mentioned later in this series), the testes are distinctly obliquely placed with regard to each other.

Yolk Glands

In all the Canadian specimens the yolk glands reach to about the level of the oesophageal bifurcation, which is placed about the junction of anterior and second quarters of the body. These yolk glands always meet across the middle line at this point.

There is a uniformity about all the drawings of *A. mühlingi* published. All have elongated forms, with the testes almost, but not quite tandem and the yolk glands ceasing at the level of the ventral sucker. In *A. crami*, the same elongated body form is found with the testes more obviously oblique and the yolk glands ceasing well posterior to the ventral sucker.

In *A. donicus* (in Ciurea's various drawings as well as in a number of specimens he kindly sent to me) there is considerable variation in body form (Fig. 3). The typical outline in expanded specimens is elongated oval, but contracted specimens are distinctly pyriform. In the former, the testes are oblique; in the latter they are almost side-by-side. However, the specimens show that the yolk glands terminate about the level of the ventral sucker and Ciurea also has drawn attention to this fact in his various papers on the subject (Plate 1, Figs. 1 and 2).

In *A. venustus*, on the other hand, which is otherwise similar to *A. donicus*, the yolk glands reach to the level of the oesophageal bifurcation (Plate I, Figs. 4, 5, 6). *R. simile* as described by Ransom, does not appear to differ specifically from this form, while *A. brevis* approaches very close to *R. donicum*.

I suggest dividing these species as follows:—

1. Yolk glands do *not* reach level of ventral sucker . . . . . *A. mühlingi.*
   A. donicus.
   A. brevis.

In this group, *A. mühlingi* has a long narrow body with the testes almost tandem; in *A. donicus* the body is oval to pyriform with the testes oblique; in *A. brevis*, the body is elongated pyriform and the testes oblique.

2. Yolk glands reach level of oesophageal bifurcation . . . . *A. venustus* (including *C. similis.*)

Minor differences between *venustus* and *donicus* lie in the testes. In the former they are always distinctly oblique, more or less spherical and fairly posterior: in the latter, they tend towards a side-by-side arrangement, although generally distinctly oblique, are more or less triangular in outline and occupy a slightly more anterior position in the body. *A. donicus* has a maximum length of 1.14 mm. and width of 0.46 mm.: *A. venustus* has a maximum length of 1.4 mm. and width of 0.55 mm. The eggs of *A. donicus* are slightly larger than those of *A. venustus* (35-40 by 19–24μ and 26–32 by 18–22μ respectively).

Accordingly, I agree with Price in regarding *similis* as a synonym of *venustus*, but not in regarding *venustus* as a synonym of *donicus*. The specimens from Canada accordingly are referred to the species *Apophallus venustus*. As will

be seen in the second part of this paper, there are certain biological differences between the American and European forms which further support this separation.

Apophallus venustus has only been recorded from eastern North America in Washington, D.C., and the lower Ottawa Valley, P.Q. It has been found in the following hosts: Dog, cat, racoon (*Procyon lotor*) Alaskan fox (*Vulpes lagopus*), harbour seal (*Phoca vitulina*) and the great blue heron (*Ardea herodias herodias*). The Alaskan fox came from the National Zoological Park in Washington City.

Apophallus donicus in the restricted sense used in this paper has been found in Europe from the following hosts, naturally or after feeding on infected fish: Dog, cat, rabbit, white mouse, *Vulpes lagopus* and *Mustela sarmatica*. It has also been recorded by Ciurea from the following birds: *Mergus merganser*, *Nycticorax nycticorax*, *Buteo buteo*, *Ciconia ciconia*, *Larus ridibundus*, *Sterna cantiaca* (the specimens in the two last-mentioned hosts were non-ovigerous), *Asio otus*, *Coturnix communis*, *Turtur communis* and *Columba livia* (the last four hosts mentioned were experimentally infected).

In addition to the specimens found in cats, a considerable number of specimens of *Apophallus* was recovered from a young loon (*Gavia immer*). The loon had only been a few days in the district and it is almost certain that its infection was not acquired locally. These specimens differ from the cat specimens in a number of points. The oesophagus is longer—about a third of the body length—and the yolk glands never reach to the bifurcation (Plate I, Fig. 3) but cease at the level of the ventral sucker. This point was quite constant in the 30 specimens examined. In all, the testes are obliquely placed to each other and are both rather more anterior than in the cat specimens.

There is considerable variation in the shape of the body, however. In some specimens this is elongated oval, but in most it lies between elongated pyriform and elongated with a more or less distinct constriction between the ventral sucker and bifurcation of the oesophagus. Using Price's criteria, some specimens could be called *A. mühlingi* and others, *A. brevis*. As however, in European specimens of *A. mühlingi* the testes are almost tandem to each other and in the present specimens they are always distinctly oblique, it would seem that it should more correctly be referred to *A. brevis*.

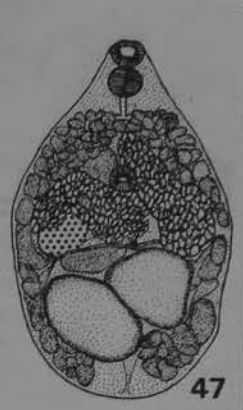
***Apophallus* sp.** (Fig. 47)

Only 4 mature examples were obtained from a wild rat.

Host : ***Proechimys longicaudatus*** (Rengger)–1 ex.
Habitat : Small intestine.
Locality : Chio, Dpto. Loreto.
Date : August 21, 1976.

If our identification would be correct this is the first record of the genus *Apophallus* from America south of Mexico.

From Miyazaki, Kifune, Habe and Uyema, 1978



Heterophyidae

Fig. 47. *Apophallus* sp. from *Proechimys longicaudatus*.
Scale : 1 mm.

APOPHALLUS

Ascocotylinae ~~n. subfam.~~ YAMAGUTI, 1958

Subfamily diagnosis. — Heterophyidae: Body small, attenuated anteriorly and enlarged posteriorly. Oral sucker drawn out posteriorly in form of a funnel, with a single or double crown of spines. Prepharynx very long, pharynx well developed, esophagus very short, ceca variable in length. Acetabulum postequatorial. Testes symmetrical, at or near posterior extremity. Seminal vesicle sigmoid, divided or not. No cirrus pouch. Acetabulogenital apparatus simple or complex. Genital pore immediately preacetabular. Ovary submedian, postacetabular. Receptaculum seminis large. Laurer's canal present. Uterus usually coiled between testes and cecal arch, but may extend further backward and forwards. Vitellaria extending in lateral fields in ovariotesticular zone or further forward beyond ovary or acetabulum, sometimes in bifurcoacetabular zone. Excretory vesicle Y- or T-shaped. Parasites of birds and mammals.

Key to genera of Ascocotylinae from birds

Vitellaria extending forward beyond ovary ..... *Ascocotyle*
Vitellaria confined to ovariotesticular zone ..... *Phagicola*

Ascocotyle Looss, 1899

Generic diagnosis. — Heterophyidae, Ascocotylinae: Body small, attenuated anteriorly, rounded posteriorly, spined. Oral sucker with a crown of spines, surmounted by a small conical lobe or lip, produced backward into a funnel-shaped blind tube. Prepharynx very long. Pharynx well developed; esophagus very short; ceca usually short and not surpassing acetabulum. Acetabulum at or near midbody. Testes symmetrical, separated one from the other by excretory vesicle at posterior extremity. Seminal vesicle sigmoid, divided or not, postacetabular. Pars prostatica well differentiated. No cirrus pouch. Genital pore immediately pre-acetabular. Ovary submedian, postacetabular. Receptaculum seminis large, medial to ovary. Laurer's canal present. Uterus usually coiled between testes and cecal arch or genital atrium. Vitellaria extending in lateral fields in ovariotesticular zone or further forward beyond ovary or acetabulum, occasionally in bifurco-acetabular zone. Excretory vesicle Y- or T-shaped, with terminal pore. Intestinal parasites of birds and mammals.

Genotype: *A. coleostoma* (Looss, 1896) Looss, 1899 (Pl. 101, Fig. 1217), syn. *Anoiktostoma coleostomum* (Looss, 1896), in pelican, Egypt. Also in *Nycticorax nycticorax;* Astrakhan. Larva in *Mugil capito* — Ciurea (1933).

Key to species — Morozov in Skrjabin (1952).

Other species:

A. filippei Travassos, 1928, in *Ardetta erythromelas, Florida caerulea, Ardea candidissima, Carbo vigua;* Brazil.
A. mcintoshi Price, 1936, in *Guara alba;* Florida.
A. megalocephala Price, 1932 in *Butorides* sp.; Puerto Rico.
A. puertoricensis Price, 1932, in *Butorides* sp.; Puerto Rico.
A. tenuicollis Price, 1935, in *Botaurus lentiginosus;* Texas.

Ascocotyle mcintoshi Price, 1936:
Metacercaria in mesenteries and viscera of ***Gambusia affinis holbrooki, Mollinesia latipinna*** — Leigh (1956).
Ascocotyle tenuicollis Price, 1935:
Metacercaria principally in ***Gambusia***, occasionally in ***Botaurus lentiginosus*** — Leigh (1956).

ASCOCOTYLE from mammals (1958)

Key to Asocotylinae from mamamls

Vitellaria extending forward beyond ovary ..... *Ascocotyle*
Vitellaria confined to ovariotesticular zone ..... *Phagicola*

Ascocotyle Looss, 1899

Generic diagnosis. — See p. 704.

Genotype: *A. coleostoma* (Looss, 1896) Looss, 1899 (Pl. 101, Fig. 1217), syn. *Anoiktostoma coleostomum* (Looss, 1896) Stoss, 1899, in pelican and dog; Egypt.

Ascocotyle Looss, 1899

DIAGNOSIS: Heterophyid trematodes of the subfamily Centrocestinae. Body small, pyriform; cuticle spinose, cercarial eyespot pigment present. Oral sucker with sensory anterior lip and posterior solid muscular appendage of varying lengths, surrounded by a membrane embedded in parenchyma of forebody; with or without crown spines. Prepharynx, pharynx, and esophagus present. Ceca 2 extending to level of acetabulum or sometimes to posterior end of body. Genital sac pore median, immediately preacetabular. Genital sac containing variously shaped, spined or unspined gonotyl(s). Testes 2 side by side in posterior half of hindbody. Seminal vesicle usually mesial, sigmoid, extending from anterior border of testes or mid-hindbody to ventrogenital sac. Ovary usually roundish in shape, usually sinistral in posterior half of hindbody, between left testis and acetabulum. Seminal receptacle present, usually dorsal to ovary. Laurer's canal absent. Uterus usually confined to area between acetabulum and testes, sometimes reaching level of pharynx. Eggs thin-shelled, clear, sometimes containing miracidia while in uterus. Vitelline follicles coarse, usually confined to outer aspect of testes, or from their posterior border to level of ovary or acetabulum. Vitelline reservoir between ovary and testes. Excretory vesicle extends from posterior excretory pore to anterior border of testes. Main excretory ducts bifurcate at level of acetabulum, giving rise to an anterior and posterior collecting tubule on each side of body. Flame cell formula 2[(2 + 2) + (2 + 2)]. Cercariae parapleurolophocercous (subgenus *Ascocotyle*), pleurolophocercous (subgenus *Phagicola*), or ophthalmogymnocephalous (new subgenus *Leighia*). Metacercariae usually encysted in myotomal musculature, gills, hearts, and other viscera of poeciliid, cyprinodont, and mugilid fishes (mainly coastal brackish-water forms), sometimes in anuran tadpoles.

TYPE SPECIES: *Ascocotyle coleostomum* Looss, 1899.

Subgenus *Ascocotyle* Travassos, 1930

ADULTS: Vitellaria extending to acetabulum, with two rows of oral spines, uterus mainly confined to postacetabular area. **Cercariae:** parapleurolophocercous, body narrow, more or less uniform in diameter from anterior to posterior end of body, oral sucker not recessed into a chamber.

TYPE SPECIES: *Ascocotyle coleostomum* Looss, 1899.

OTHER SPECIES: *Ascocotyle* (*A.*) *branchialis*, *A.* (*A.*) *intermedius*, *A.* (*A.*) *leighi*, *A.* (*A.*) *puertoricensis*, and *A.* (*A.*) *tenuicollis*.

Subgenus *Leighia*, new subgenus

ADULTS: Vitellaria extending to acetabulum, with two rows of oral spines, uterus extending to level of pharynx. **Cercariae:** ophthalmogymnocephalous, body subspherical, oral sucker recessed into a chamber.

TYPE SPECIES: *Ascocotyle* (*L.*) *mcintoshi* Price, 1932.

OTHER SPECIES: *Ascocotyle* (*L.*) *megalocephala*.

Subgenus *Phagicola* Faust, 1920

ADULTS: Vitellaria extending to level of ovary, with one, two, or no rows of oral spines. Uterus mainly confined to postacetabular area. **Cercariae:** pleurolophocercous, body usually pyriform when at rest, oral sucker not recessed into a chamber.

TYPE SPECIES: *Ascocotyle* (*Phagicola*) *pithecophagicola*. (Faust, 1920) Faust and Nishigori, 1926.

OTHER SPECIES:

pithecophagicola group: One row of oral spines. Gonotyl of double-pad type. *A.* (*P.*) *pithecophagicola*, *A.* (*P.*) *arnaldoi*, *A.* (*P.*) *ascolonga*, *A.* (*P.*) *byrdi*, *A.* (*P.*) *inglei*, *A.* (*P.*) *longicollis*, *A.* (*P.*) *longa*, *A.* (*P.*) *macrostomus*, *A.* (*P.*) *micracantha*, *A.* (*P.*) *sinoecum*.

minuta group: One row of oral spines. Gonotyl of single-pad type. *A.* (*P.*) *minuta*, *A.* (*P.*) *italica*.

angrense group: One row plus a few dorsal accessory crown spines. Gonotyl of single-pad type. *Ascocotyle* (*P.*) *angrense*.

angeloi group: Two rows of oral spines. Gonotyl of single-pad type. *Ascocotyle* (*P.*) *angeloi*, *A.* (*P.*) *ampullacea*.

mollienesicola group: No oral spines. Gonotyl of single-pad type. *Ascocotyle* (*P.*) *mollienesicola* n. comb. (Synonym: *Pseudascocotyle mollienesicola* Sogandares and Bridgman, 1960.)

Sogandares & Lumsden, 1963

Looss (1896) described *Distomum coleostomum*, a species which was incorrectly transferred to the genus *Anoiktostoma* Stossich, 1899 (family Acanthostomidae) by Stossich (1899). Looss (1899) established the genus *Ascocotyle* for *Distomum coleostomum*, also describing a second species, *A. minuta*. Alessandrini (1906) added another species, *A. italica*. Travassos (1916) described *A. angrense*, and Ransom (1920) *A. nana* and *A. longa*. Faust (1920) named the genus *Phagicola*, with *P. pithecophagicola* Faust, 1920 as type species, although Faust and Nishigori (1926) subsequently transferred this species to the genus *Ascocotyle*. Stunkard and Haviland (1924) named and described *A. diminuta*, establishing the subgenus *Parascocotyle* for *A. minuta* (type species) and *A. diminuta*. Linton (1928) described *Ascocotyle plana*. Travassos (1928) described *A. arnaldoi*, and (1929a) *A. filippei* and *A. angeloi*. Witenberg (1929) raised *Parascocotyle* to generic rank, assigning to this genus the species *minuta, italica, nana, longa, pithecophagicola*, and a new species *P. ascolonga* Witenberg, 1929. Witenberg (1929) further proposed that *Ascocotyle* (*Parascocotyle*) *diminuta* was a synonym of *P. minuta* (Looss, 1899). Travassos (1930) suppressed *Parascocotyle* as a synonym of *Phagicola*, which he regarded as a subgenus of *Ascocotyle*. He included in the subgenus *Ascocotyle*: *A. coleostoma*, and *A. filippei*; in the subgenus *Phagicola*: *A. minuta, A. italica, A. angrense, A. longa, A. nana, A. pithecophagicola, A. diminuta, A. arnaldoi, A. angeloi*, and *A. ascolonga*. *A. plana* was regarded as identical with *A. angrense*, although Witenberg (1929) stated that *A. plana* was a synonym of *Pygidiopsis genata* Looss, 1907. Price (1933a) reexamined Linton's type specimens of *A. plana* and regarded this taxon a valid species of the genus *Pygidiopsis*. Price (1932a) agreed with Travassos (1930) on the identity of *Phagicola* and *Parascocotyle*, although he believed the characters separating *Ascocotyle* and *Phagicola* warranted generic rather than subgeneric status. Price (1932a) therefore reinstated the genus *Phagicola* Faust, 1920. He suppressed the genus *Parascocotyle* Stunkard and Haviland, 1924, as a synonym of *Phagicola* on the basis of date priority. Price (1932a) ascribed to the genus *Phagicola* those species included by Travassos (1930) in the subgenus *Phagicola* and added *P. piriforme* (Blanc and Hedin, 1913) Price, 1932 [= *Echinostoma piriforme* Blanc and Hedin, 1913, according to Nicoll (1923) a synonym of *A. italica*]. Ciurea (1933) named the genus *Metascocotyle*, with *M. witenbergi* as type species. Price (1935) later suppressed this genus and species as synonyms of *P. longa* (Ransom, 1920).

Seven species of *Ascocotyle* and eight species of *Phagicola* have been named and described subsequently to those cited above: (1) *A. mcintoshi* Price, 1932, (2) *A. megalocephala* Price, 1935, (3) *A. puertoricensis* Price, 1932, (4) *A. tenuicollis* Price, 1935, (5) *A. leighi* Burton, 1956, (6) *A. branchialis* Timon-David, 1961, and (7) *A. ampullacea* Miller and Harkema, 1962; (1) *Phagicola sinöecum* (Ciurea, 1933), (2) *P. intermedius* Srivastava, 1935, (3) *P. lageniformis* Chandler, 1941, (4) *P. byrdi* Robinson, 1956, (5) *P. macrostomus* Robinson, 1956, (6) *P. inglei* Hutton and Sogandares, 1958, (7) *P. longicollis* Kuntz and Chandler, 1956, and (8) *P. micracantha* Coil and Kuntz, 1960.

The status of the various groups comprising the *Ascocotyle* complex of species is still unsettled. Stunkard and Uzmann (1955) regarded *Phagicola* a subgenus of *Ascocotyle*, although Martin (1951, 1953), Burton (1958), Yamaguti (1958), and Hutton and Sogandares (1958) supported the generic status of *Phagicola*. Hutton and Sogandares (1958) further regarded *Parascocotyle* Stunkard and Haviland, 1924, as a valid genus. Subsequently, Sogandares and Bridgman (1960) described the genus *Pseudascocotyle*, with *P. mollienisicola* as the type species and recognized the subfamily Ascocotylinae Yamaguti, 1958 as containing four genera (or subgenera) sensu stricto: *Ascocotyle, Parascocotyle, Phagicola*, and *Pseudascocotyle*. Out of this nomenclatorial tangle, one thing, overlooked by the senior author in previous publications, becomes clear. The name *Parascocotyle* Stunkard and Haviland, 1924 is not available as a generic name because its type species, *Ascocotyle minuta* Looss, 1899 is a species of *Phagicola* as previously defined (Hutton and Sogandares, 1958 and Sogandares and Bridgman, 1960) by possessing a single row of oral spines and vitellaria to the ovary. As Price (1932a) has stated, *Parascocotyle* is a synonym of *Phagicola* by reason of date priority. Furthermore, reexamination of the type slides of *A. nana* (USNM Helm. Coll. No. 19030) and of adult worms experimentally obtained by feeding gills of several fishes to laboratory reared and raised mammals have convinced us that *Ascocotyle nana, A. diminuta*, and *Phagicola lageniformis* are synonyms of *A. angrense*. Therefore, the "species group" composed of forms with a single row and an incomplete dorsal accessory row of oral spines no longer exists. As a result, the views held by the senior author in former papers (1958, 1960) are no longer tenable. The following systematic scheme is tentatively proposed for the *Ascocotyle* complex of species. We are deeply indebted to Professor W. Henry Leigh, Department of Zoology, University of Miami, for information concerning cercariae of the *Ascocotyle* complex of species, based on his extensive studies of life histories in that group.

Sogandares-Bernal 1963

Ascocotyle angrense Travassos, 1916

(Figs. 1 to 29)

NEW SYNONYMS: *Ascocotyle nana* Ransom, 1920, *Ascocotyle diminuta* Stunkard and Haviland, 1924, and *Phagicola lageniformis* Chandler, 1941.

SECOND INTERMEDIATE HOSTS: Gill filaments of poeciliid and cyprinodont fishes (see above).

DEFINITIVE HOSTS: Usually in duodenum of ardeiform birds and sometimes of mammals (see above).

LOCALITIES: Along eastern coast of the American continent (see above).

DIAGNOSIS: *Ascocotyle.* Body usually pyriform in shape, 0.218 to 0.790 long by 0.115 to 0.380 in maximum width. Forebody highly variable in length due to contraction. Hindbody 0.081 to 0.205 long. Cuticle spinose to posterior end of body. Remnant of cercarial eyespot pigment in anterior ¼ to ⅓ body. Oral sucker terminal; with prominent preoral sensory lobe and posterior solid contractile muscular appendage of variable length, surrounded by membranous sheath embedded in parenchyma of forebody; bearing anterior row of 16 to 18 crown spines 0.010 to 0.022 long by 0.002 to 0.008 wide at their bases, and posterior accessory dorsal row of from 2 to 3 spines 0.006 to 0.012 long by 0.001 to 0.006 wide at their bases. Acetabulum mesial, equatorial, or postequatorial, depending upon contraction of forebody; 0.031 to 0.056 in diameter. Prepharynx extending posteriorly from base of oral sucker at base of muscular appendage; 0.070 to 0.132 long. Pharynx connecting with posterior end of prepharynx; 0.019 to 0.058 long by 0.017 to 0.039 wide. Esophagus extending posteriorly from its connection with hind end of pharynx; 0.006 to 0.070 long. Ceca 2, usually extending posteriorly from their connection with hind end of esophagus, one on each side of body, to posterior border of acetabulum or slightly beyond.

Genital sac pore mesial, immediately preacetabular; followed by genital sac containing muscular gonotyl of varying shape, depending upon contraction, with six spines (best observable in live excysted metacercariae). Testes 2, with smooth edges, side by side, in posterior half of hindbody; 0.025 to 0.100 long by 0.039 to 0.130 wide. Seminal vesicle usually sigmoid in shape, extending from midway between acetabulum and testes or anterior border of testes to genital sac. Ovary variable in shape, never deeply lobed, with smooth edges, sinistral, midway between acetabulum and left testis or closely approximating inner aspect of anterior border of left testis; 0.014 to 0.100 long by 0.020 to 0.082 wide. Oviduct originating at posterior end of ovary, ciliated where it becomes ootype. Mehlis' gland present around ootype. Laurer's canal not observed. Vitellaria usually composed of coarse follicles extending from posterior edge of testes, along lateral external aspect, partially overlapping testes along their anterior extent, to end at anterior level of testes or ovary. Uterus extending in transverse loops from Mehlis' complex, mainly restricted to hindbody between testes and acetabulum, to enter genital sac; muscular metraterm absent. Eggs containing live miracidia while in portion of uterus distal to ovary; 0.014 to 0.022 long by 0.008 to 0.014 wide. Excretory vesicle extending anteriorly from mesial excretory pore at posterior end of body, following contour of inner aspect of testes anteriorly, to end at anterior border of testes. Main collecting tubules bifurcating about at level of acetabulum. Flame cell formula of metacercariae and gravid adults 2[(2 + 2) + (2 + 2)].

FIGURES 9 TO 16. *Ascocotyle angrense.* The projected scales are in millimeters.

9. Ventral view of specimen from natural infection of *Florida thula.*
10. Same, crown spines. FIGURE 10A. Same, eggs.
11. Dorsal view of specimen from natural infection of *Nyctinassa violacea.*
12. Same, eggs.
13. Same, crown spines.
14. Ventral view of specimen from natural infection of *Butorides striata.*
15. Same, eggs.
16. Same, crown spines.

TABLE I. *Comparative table of measurements for various species of* Ascocotyle.

Characters	Species				
	A. angrense (from Travassos, 1930)	*A. nana* (from Ransom, 1920)	*A. diminuta* (from Stunkard and Uzmann, 1956)	*A. lageniformis* (from Chandler, 1941)	*A. angrense* (this paper)[4]
Body length	0.460–0.640	0.610–0.790	0.200–0.440	0.450–0.630	0.218–0.640
Body width	0.250–0.360	0.250–0.380	0.110–0.240	0.230–0.260	0.115–0.294
Oral sucker diameter	0.062–0.085	0.035–0.045	0.025–0.042	0.060[1]	0.031–0.067
Prepharynx	0.100	not given	not given	not given	0.007–0.132
Pharynx length	0.044–0.058	0.032–0.045	0.019–0.025	0.033–0.038	0.022–0.056
Acetabulum diameter	0.050–0.070	0.045–0.070	0.030–0.040	0.040–0.050	0.031–0.056
Ovary length	0.049–0.079	0.050–0.100	not given	"slightly smaller than testes"	0.014–0.053
Ovary width	0.072–0.082	0.055–0.080	not given	see above	0.020–0.062
Testes length	0.062–0.086	0.055–0.100	0.030–0.050	0.060–0.070	0.025–0.070
Testes width	0.100–0.130	0.070–0.120	0.040–0.070	0.035–0.090	0.039–0.126
Egg length	0.020	0.018–0.024	0.016–0.020	0.020–0.021	0.014–0.020
Egg width	0.010–0.011	0.010–0.016	0.010–0.011	0.010–0.012	0.008–0.014
Number oral spines anterior row	16–18[2]	16–20[3]	16	16	16–18
Number oral spines posterior row	2	not defined	2	2	2–3

NOTES ON THE SYSTEMATICS OF *Ascocotyle angrense*

Travassos (1916) described *A. angrense* from *Butorides striata* in Brazil. He later (1930) redescribed the species and pictured the type material. Ransom (1920) named and described *Ascocotyle nana* from an Alaskan fox which died in the National Zoological Park in Washington, D. C. Although the fact was not mentioned in Ransom's description, his material was cytolized and in extremely poor condition. Ransom also did not note a second accessory row of crown spines and instead cited the total number of crown spines in his material. Price (1933b) reported *A. nana* from a booby bird in Puerto Rico, properly redescribing the oral spination of this species. Byrd and Reiber (1942) described a single specimen identified as *Ascocotyle nana* from a muskrat in Louisiana. Their specimen had lost several crown spines. Stunkard and Haviland (1924) described *Ascocotyle diminuta* from rats at the Clason Point dump, New York. Their material was reportedly partially cytolized and had lost some crown spines. Stunkard and Uzmann (1955) redescribed *A. diminuta* and studied part of its life history. Chandler (1941) described *Phagicola lageniformis* from muskrats in Texas, and Martin (1953) studied its partial life history. Sogandares and Bridgman (1960) regarded *A. diminuta* and *P. lageniformis* as identical, but did not synonymize the species because of the possibility of morphologically identical physiological strains or species. Harkema and Miller (1962) agreed with Sogandares and Bridgman (1960) that *A. diminuta* and *P. lageniformis* are identical. Present evidence indicates that not only are *Ascocotyle diminuta, A. nana,* and *P. lageniformis* morphologically identical, but that they in turn are synonyms of *A. angrense*. Host specificity might separate these species, but the variation in adults from several experimental hosts clearly indicates that one species is involved. Table I shows comparative measurements of *A. angrense* and its synonyms.

The known hosts and geographical distribution of *A. angrense* and its synonyms are as follows:

SECOND INTERMEDIATE HOSTS:

DEFINITIVE HOSTS:

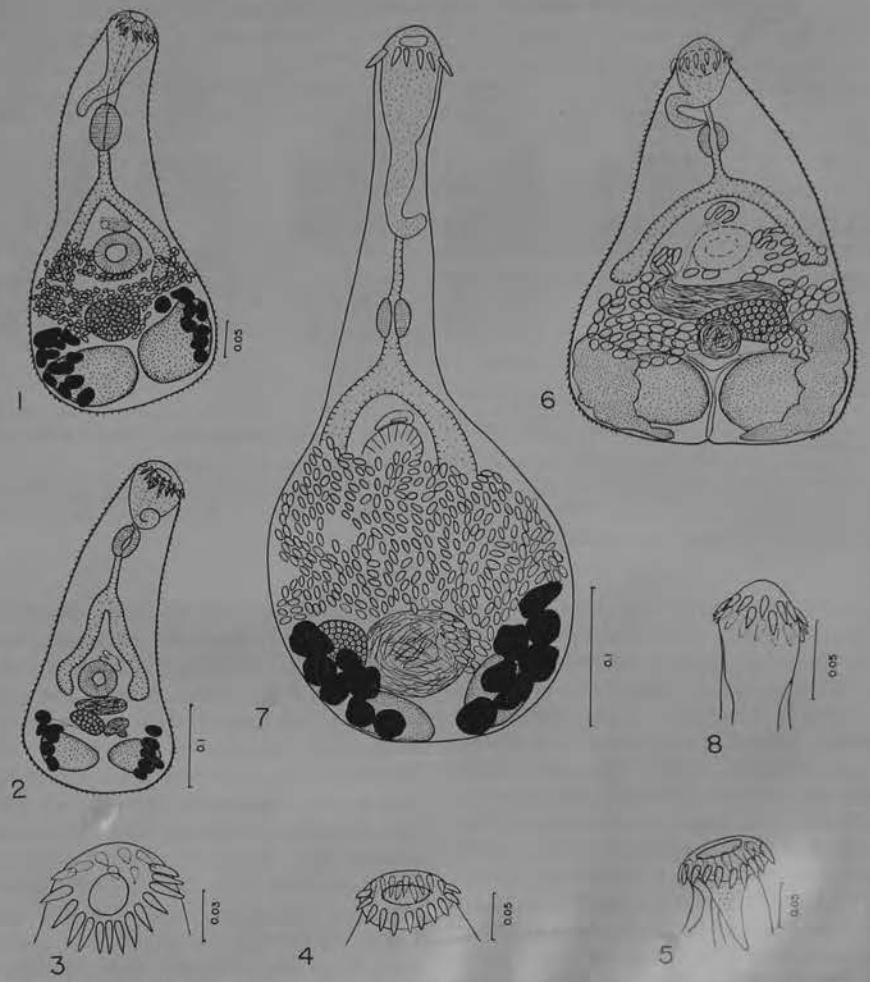
NOTES ON THE BIOLOGY OF *Ascocotyle angrense*

We have observed that cuticular and crown spines may be lost, vitelline follicles lose their compact shape and become diffusely granular, and the gonotyl loses its identity in specimens that are moribund and partially cytolized previous to fixation. Additionally, the numbers and shapes of crown spines may vary in living specimens. We have even observed one metacercaria in which there was one bifid spine in the dorsal accessory row. The crown spines in certain specimens may be delicate and slender while in other specimens they may be heavy and recurved. We do not know if these differences in size and shape of crown spines are specifically due to the age and size of the metacercaria prior to ingestion by the definitive host, to the host, host diet, age of the worms, or to a combination of these factors. Figures 10, 13, 16, 18, 22, 23, and 26 show shape and size variation of crown spines observed in this study.

Body length is often dependent upon the size and age of the metacercariae previous to ingestion by the definitive host and upon recency of infection. Stunkard and Uzmann (1955) found that the smaller and younger metacercariae fed to rats, mice, and hamsters sometimes require up to a week to produce eggs. However, they found gravid worms in rats and mice 3 days after exposure to metacercariae. Our own observations of experimental infections of these hosts support and extend those of Stunkard and Uzmann (1955). We have found initiation of egg production in specimens 48 hr after exposure of mice to metacercariae as did Martin (1953) using chicks.

The length of the muscular oral appendage may vary with contraction of this organ and of the forebody (Witenberg, 1929; Martin, 1953; Sogandares and Bridgman, 1960).

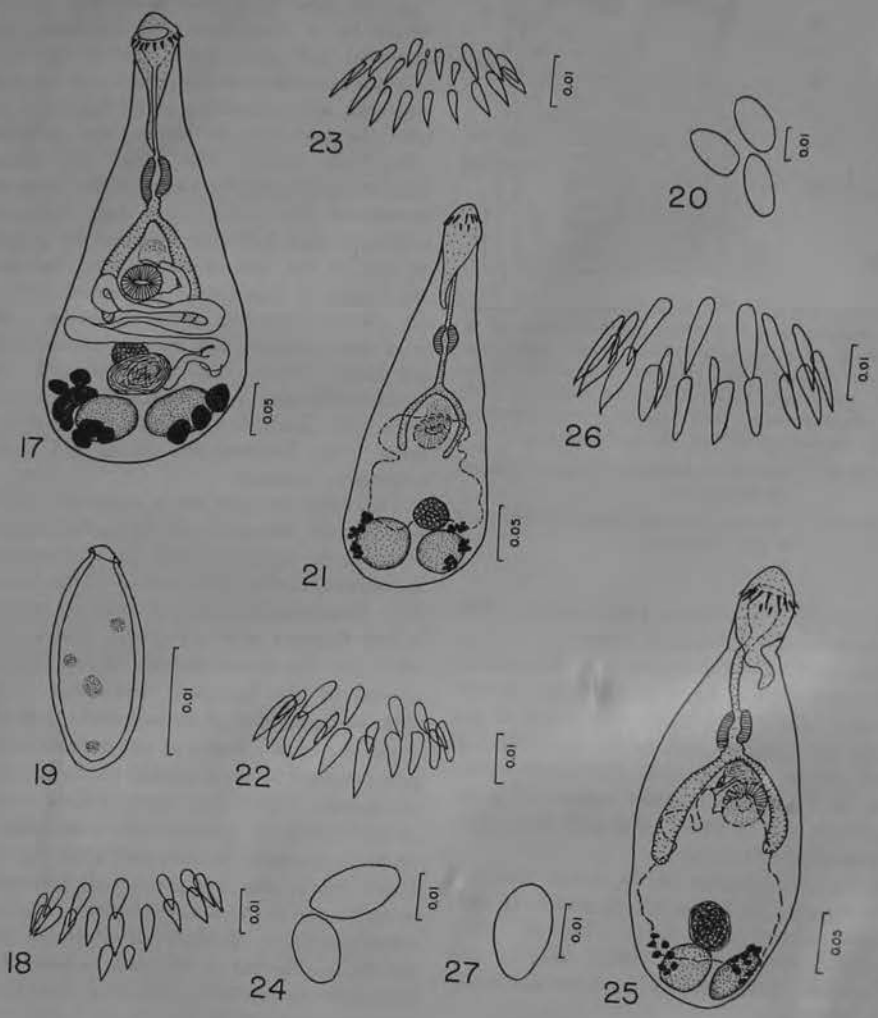
The factors cited above are often disregarded by certain authors when naming new species. We also believe that unless large series of any *Ascocotyle* species, preferably from different hosts, are studied, specific differences attributed to one or two crown spines in single specimens are of little value and serve only



FIGURES 1 TO 8. *Ascocotyle angrense* (Figs. 1 to 5 after Travassos, 1930; Fig. 6 after Stunkard and Uzmann, 1955; Figs. 7 and 8 after Chandler, 1941). The projected scales are in millimeters.

FIGURES 1 AND 2. Ventral view of specimens from *Ardetta erythromelas*.
FIGURE 3. Crown spines of specimen from *A. erythromelas*.
FIGURES 4 AND 5. Crown spines of type material from *Butorides striata*.
FIGURE 6. Dorsal view of "*Ascocotyle diminuta*."
FIGURE 7. Ventral view of "*Phagicola lageniformis*" from Texas muskrat.
FIGURE 8. Same, crown spines.

From Sogandares + Lumsden 1963



FIGURES 17 TO 25. *Ascocotyle angrense*. The projected scales are in millimeters.

FIGURE 17. Ventral view of specimen from 72-hr experimental infection of hamster.

FIGURE 18. Same, crown spines.

FIGURES 19 AND 20. Same, eggs.

FIGURE 21. Dorsal view of specimen from a 212-hr experimental infection of CF_1 laboratory white mouse, area covered by uterus is outlined by dashed lines.

FIGURES 22 AND 23. Same, crown spines, note rudimentary spine of anterior row in latter figure.

FIGURE 24. Same, eggs.

FIGURE 25. Dorsal view of specimen from natural infection of *Procyon lotor*, area covered by uterus outlined by dashed line.

FIGURE 26. Same, crown spines.

FIGURE 27. Same, eggs.

Ascocotyle ampullacea sp. n. MILLER + HARKEMA, 1962
(Figure 1)

Description: (Measurements in microns, based on fifteen specimens.) Body flask-shaped, tapering towards anterior end. Cuticle covered with small, scalelike spines, but spination reduced behind oral sucker and on posterior body. Length 476 to 680; width 190 to 441 at widest part. Oral sucker subterminal with rounded anterior lip and surrounded by two alternating rows of spines. Each row with 20 to 24 spines, usually 22. Spines very small, 5 to 7 microns dorsally, 4 to 6 ventrally. Oral sucker 40 to 59 in transverse diameter, with elongated oral appendage extending one-fourth to one-half distance to pharynx. Pharynx 50 by 43, located 132 to 172 from anterior end of body. Esophagus short, 26 to 40. Ceca extend posteriorly to level of ovary where they are covered by uterus and difficult to see in whole mounts. Acetabulum 66 by 70, approximately in equatorial zone. Genital pore slit-like, immediately preacetabular, slightly sinistral. Gonotyl prominent, usually recessed, with lobe containing 10 to 20 spines which approximate size of oral spines. Testes 2, transverse-ovoid, smooth, situated side by side at posterior end of body; right testis, 46 to 99 by 76 to 119; left testis, 43 to 96 by 66 to 112. Seminal vesicle large, medio-dorsal, posterior to acetabulum. Ovary transverse-ovoid, sometimes round, smooth, located ventrally just anterior to medial margin of right testis, length 53 to 82, width 53 to 109. Oviduct arising from dorso-posterior surface of ovary. Mehlis' gland inconspicuous, seminal receptacle voluminous, distended with sperm, located dorsal to ovary and of comparable size. Laurer's canal present. Uterus consisting of 4 to 6 transverse loops between anterior margin of testes and genital pore. Eggs numerous, 19 to 23 by 10 to 13. Vitellaria follicular, 6 to 9 follicles on each lateral border of testes, extending to anterior margin of ovary. Excretory vesicle appearing as clear zone between testes.

Host: *Procyon lotor.*

Habitat: Small intestine.

Locality: Brunswick and Dare Counties, North Carolina.

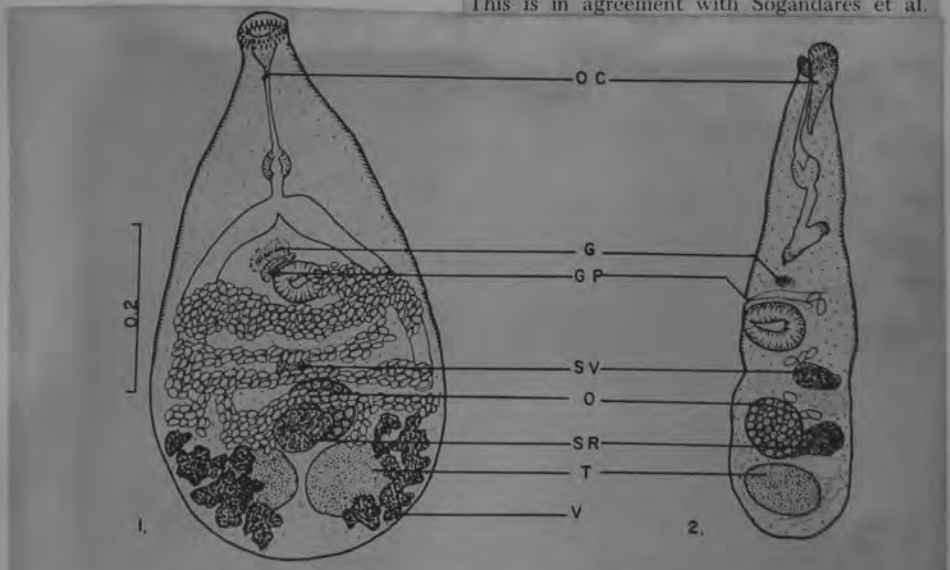
Specimens: U.S.N.M. Helm. Coll. No. 59584, including sagittal sections.

designation, *ampullacea*, refers to the flask-like shape of the worm.

Burton (1958) recognizes 8 species in the genus *Ascocotyle*. To this list should be added *Ascocotyle angeloi* Travassos, 1928, which both Burton and Yamaguti (1958) placed in the genus *Phagicola*. Following the conclusions of Hutton and Sogandares-Bernal (1958) and Sogandares-Bernal and Bridgman (1960), we place our species in the genus *Ascocotyle* on the basis of the double row of oral spines. *A. ampullacea* most nearly resembles *A. angeloi* and both species have characteristics that are intermediate between the genera *Ascocotyle* and *Phagicola*. *A. ampullacea* differs from *A. angeloi* in its smaller size, shorter ceca, larger oral sucker, and larger acetabulum. It further differs in having 22, not 14, oral spines in each row and the spines are much smaller. In addition *A. ampullacea* has a very prominent gonotyl with a distinct row of spines. Travassos (1928, 1930) stated that the genital atrium of *A. angeloi* contains a small muscular bulb difficult to see, but made no mention of spines.

Recently, Sogandares-Bernal and Bridgman (1960) described a fourth genus in the *Ascocotyle* complex, *Pseudascocotyle*. This genus is characterized mainly by the complete absence of oral spines and the penetration of the gonotyl by the uterus. Except for these two features and minor characteristics, *A. ampullacea* looks very much like *Pseudascocotyle mollienisicola* Sogandares-Bernal and Bridgman, 1960. These features, however, are of sufficient magnitude to warrant separate consideration.

Sogandares-Bernal and Bridgman (loc. cit.) stated: "Within a phylogenetic scheme, *A. angeloi* would tend to reinforce the closeness of relationship between *Ascocotyle*, *Phagicola*, *Parascocotyle*, and *Pseudascocotyle*." *A. ampullacea* further substantiates this relationship, indicating perhaps only a subgeneric value for the four groups within the genus *Ascocotyle*. This is in agreement with Sogandares et al.



EXPLANATION OF FIGURE

Abbreviations: G, gonotyl; GP, genital pore; O, ovary; OC, oral cecum; SR, seminal receptacle; SV, seminal vesicle; T, testes; V, vitellaria. (Scale in mm.)

FIGURE 1. *Ascocotyle ampullacea*. 1, whole mount, dorsal view; 2, parasagittal section, composite of two sections.

Heterophyidae

The following diagnosis is based on ten mechanically excysted metacercariae from *Cyprinodon variegatus*. All measurements (in millimeters) were taken from heat-killed specimens subsequently placed in Bouin's picro-formol-acetic fixative.

Ascocotyle chandleri, n. sp. (Fig. 1) Lumsden, 1963

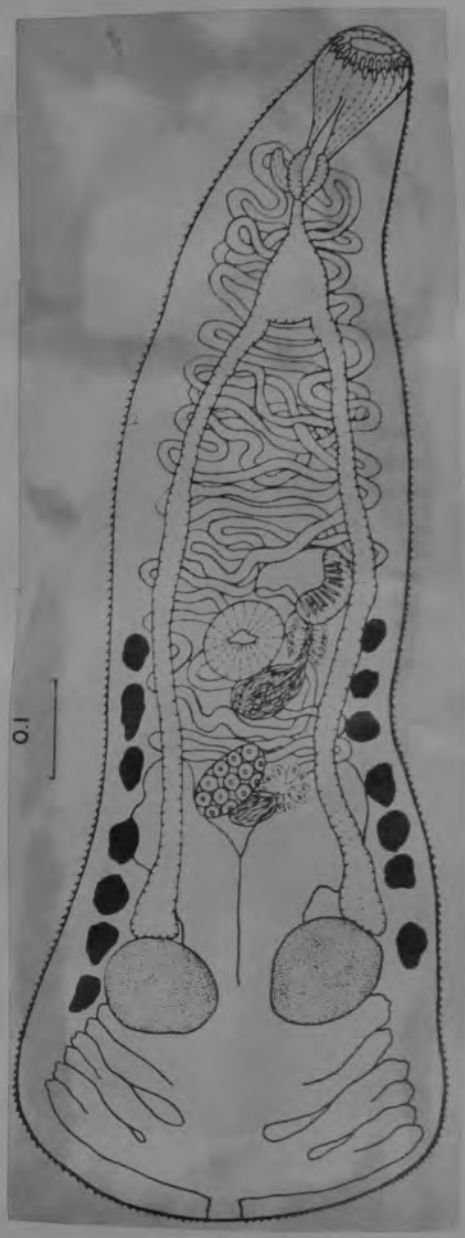
DIAGNOSIS: *Ascocotyle*. Body pyriform, 0.780 to 1.020 long by 0.150 to 0.270 in maximum width. Forebody 0.450 to 0.570 long in extended specimens. Cuticle entirely spinose. Remnants of cercarial eyespots in anterior ⅓ of body. Oral sucker terminal, 0.063 to 0.065 in transverse diameter, with preoral sensory lobe and posterior conical appendage of variable length. Circumoral spines 0.012 to 0.015 long by 0.005 wide at their bases, arranged in two complete rows of 27 spines each. Acetabulum immediately postequatorial in extended specimens, 0.052 to 0.058 long by 0.062 to 0.065 wide. Sucker width ratio approximately 1:1.0. Prepharynx 0.040 to 0.075 long. Pharynx 0.038 to 0.052 long by 0.028 to 0.042 wide. Esophagus 0.048 to 0.075 long, usually dialated at junction with ceca. Ceca two, terminating blindly in posterior ½ of hindbody. Genital sac pore sinistral to midline of body, immediately preacetabular, followed by genital sac containing sinistral, longitudinally oriented muscular gonotyl. Gonotyl of single pad type bearing a single row of approximately 10 spines 0.012 long by 0.002 wide at their bases. Testes two, 0.050 to 0.075 long by 0.055 to 0.075 wide, side by side in posterior ½ of hindbody; posttesticular space 0.085 to 0.156 long. Seminal vesicle sigmoid shaped, sinistral, extending from hindmargin of acetabulum to connect with small prostatic vesicle; prostatic vesicle surrounded by prostatic gland cells, connecting with short muscular genital atrium which perforates genital sac posteriodorsally. Ovary transversely ovoid, dextral, in anterior ½ of hindbody, 0.025 to 0.035 long by 0.045 to 0.050 wide. Mehlis' complex sinistral to ovary. Seminal receptacle at level of Mehlis' complex, extending dorsally from junction with oviduct. Ootype ciliated. Laurer's canal not observed. Uterus in transverse loops between levels of ovary and pharynx. Distal end of uterus nonmuscular, joining with prostatic vesicle to form short muscular genital atrium. Vitellaria composed of seven follicles on each side of body lateral to ceca, extending from near hindmargin of testes to midlevel of acetabulum. Excretory vesicle with two pairs of branched posttesticular lateral diverticula; pretesticular limbs of excretory vesicle generally following contour of anterior and mesial aspects of testes; main collecting tubules arising at level of ovary, bifurcating at level of acetabulum. Flame cell formula 2((2+2)+(2+2))=16. Excretory pore terminal.

SECOND INTERMEDIATE HOSTS: *Cyprinodon variegatus* Lacepede, pupfish (Family Cyprinodontidae) and *Mollienesia latipinna* Le Sueur, sailfin molly (Family Poeciliidae).

LOCATION: Liver.

LOCALITY: Northwest end of Galveston Bay, Texas.

HOLOTYPE AND PARATYPE: U. S. National Museum Helminthological Collection 59894.



DISCUSSION

The systematic designation of species groups comprising the *Ascocotyle* complex of species has been much disputed. In a recent review of the subfamily Ascocotylinae Yamaguti, 1958, Sogandares and Lumsden (1963) concluded that species previously assigned to *Ascocotyle* Looss, 1899, *Phagicola* Faust, 1920, *Parascocotyle* Stunkard and Haviland, 1924, and *Pseudascocotyle* Sogandares and Bridgman, 1960, are members of a single genus, *Ascocotyle* Looss, 1899. These investigators retained *Ascocotyle* Travassos, 1930, and *Phagicola* as subgenera, and erected a third subgenus, *Leighia*. *Parascocotyle* and *Pseudascocotyle* were suppressed as synonyms of *Phagicola*.

The anterior extent of the uterus (to the level of the pharynx) and vitelline distribution place *A. chandleri* in the subgenus *Leighia*, erected by Sogandares and Lumsden (1963) for *A. mcintoshi* Price, 1932, and *A. megalocephala* Price, 1935. *A. chandleri* is readily distinguished from these two species by the number of circumoral spines (two rows of 27 spines each in *A. chandleri* vs. 18 to 20 per row in *A. mcintoshi* and 36 per row in *A. megalocephala*) and the presence of a laterally branched excretory vesicle. In all other species of *Ascocotyle*, the excretory vesicle has a simple V-shaped form which follows the contour of the testes and ends at their anterior margins. *A. chandleri* otherwise closely resembles *A. mcintoshi*. The compressed, beaker-shaped body and preacetabular distribution of the vitellaria in *A. megalocephala* further distinguishes this species from *A. chandleri*.

The metacercarial cysts of *A. chandleri* are spherical, measure 0.363 to 0.407 in diameter with a hyaline wall approximately 0.010 thick. The cysts occur most frequently beneath the endothelium of the hepatic sinusoids, where their presence stimulates a local fibrosis of the host tissues. The outer aspect

- OVER -

of the cyst wall is invested with a thick layer of host fibroblasts and collagen fibers. A similar host tissue reaction occurs in the *bulbus arteriosus* and gill filaments of *Mollicuesia* infected with metacercariae of *A. leighi* Burton, 1956, and *A. angrense* Travassos, 1916, respectively.

Six to ten encysted metacercariae obtained from the livers of naturally infected *Cyprinodon variegatus* were administered to each of nine one-day-old chicks. One immature specimen of *A. chandleri* was found in the posterior small intestine of a chick examined 24 hours after exposure to the metacercariae. A second worm, 0.900 in total length, with a few capped uterine ova measuring 0.017 long by 0.011 wide, was recovered from the anterior portion of the large intestine of a chick at 29 hours. No worms were recovered from the remaining chicks autopsied at 12 hour intervals between 40 and 72 hours postexposure. Similar experiments were conducted employing laboratory reared hamsters approximately 45 days old. These hosts proved refractory to infection with *A. chandleri*. A single immature trematode agreeing in all details with *A. chandleri* was recovered from the small intestine of an egret, *Casmerodius albus* (Linn.) collected near the type locality.

Ascocotyle coleostoma (Looss, 1896)

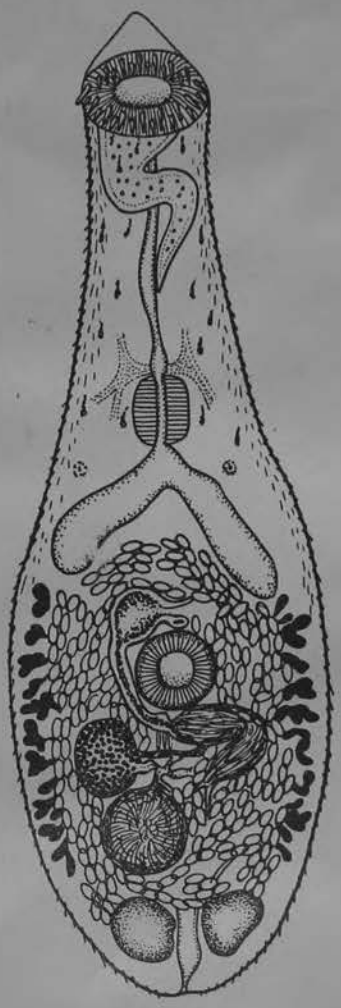
Синонимы: *Distomum coleostomum* Looss, 1896; *Anoiktostoma coleostoma* (Looss, 1896), Stossich, 1899; *Distomum coleostomum* (Looss, 1896), Vaulleguard, 1901

(Рис. 88)

Дефинитивные хозяева: розовый пеликан (*Pelecanus onocrotalus*); кошка (*Felis catus domesticus*), собака (*Canis familiaris*).

Локализация: взрослые — в толстых кишках.

Место обнаружения: Египет.



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88. *Ascocotyle coleostoma* (Looss, 1896) (по Рансому, 1920)

Ascocotyle filippei Travassos, 1928

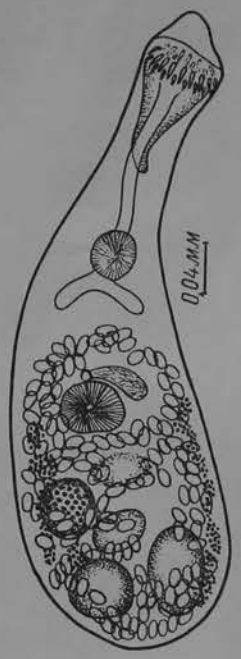
(Рис. 89)

Дефинитивные хозяева: *Ardetta erythromelas*; *Florida coerulea*, *Ardea caudiclussiura*, *Corbo vigua*.

Локализация: кишечник.

Место обнаружения: Бразилия.

Описание вида (по Травассосу, 1928). Тело продолговато-овальное, передний конец его сплюснут дорзо-вентрально. Длина тела 0,51 мм, ширина 0,16 мм. Кутикула покрыта шипиками 0,003 мм длины. Ротовая присоска субтерминальная, 0,015 мм в поперечном диаметре, от дорзальной стенки ее отходит вперед треугольный сосочкообразный вырост. Рот окружен двумя рядами шипов, по 18 в каждом ряду. Шипы



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Ascocotyle (Phagicola) intermedius ~~N. Sp.~~ — Srivastava, 1935 Heterphyidae

A large number of these minute distomes were obtained from the intestine of the Indian Fishing-eagle—*Haliaeetus leucoryphus*. In the living condition they are quite active and show considerable power of contraction and expansion especially in the anterior half of the body. In their natural habitat the parasites appear like tiny masses of yellowish brown pigment. Normally the body is pyriform in outline but in extended condition the sides become almost parallel while the contracted worm may be as wide as long. The dorsal lip may be extended anteriorly in the form of a triangular process or retracted into a short knob. In permanent mounts the parasite has a thin flat body with a flask-shaped outline, measuring 0·6—0·9 * in length and 0·2—0·38 in maximum breadth across the anterior margin of the ovary. The body is uniformly studded with minute backwardly directed spines of 0·005 × 0·002 size, which diminish both in number and size as they approach the posterior end.

The oral sucker is terminal, measuring 0·04—0·05 in diameter; it is surrounded by two crowns of alternating cylindrical and abruptly-pointed spines, about 28—30 in number. These spines are quickly shed when the worms are placed in normal salt solution or tap water. The spines in the anterior crown measure 0·01—0·013 × 0·003 in size while those in the hinder crown measure 0·009—0·01 × 0·003. The feebly muscular acetabulum, spherical in outline and 0·066—0·077 in diameter, is situated about the middle of the body. The size ratio between the oral and the ventral suckers is as 2: 3. Both the acetabulum and the genital pore lie in a shallow depression—the ventro-genital sinus—on the ventral body surface. The genital sinus or ductus hermaphroditicus opens in this depression just in front of the acetabulum. The genital opening is guarded on the anterior and posterior sides by two muscular, transversely elongated pads, lenticular in shape,—the gonotyls of Witenberg,—which measure 0·04—0·05 × 0·013 in size.

The excretory pore is terminal lying at the extreme posterior end of the body. The bladder is typical of the genus and consists of a short main stem which bifurcates just behind the receptaculum seminis into two short but wide cornua.

The oral sucker has a posterior hollow, conical prolongation—the oral appendage or caecum—of 0·04—0·05 × 0·03 size, which is situated on the dorsal side of the prepharynx. The prepharynx is long, measuring 0·06—0·09 in length. The muscular pharynx, 0·03—0·04 × 0·02—0·03 in size, is followed by a short oesophagus of 0·03—0·08 length. The wide intestinal caeca are moderately long terminating posteriorly in level with the anterior margin of the ovary.

The gonads are well developed and lie in the posterior half of the body. The testes are situated symmetrically with their long axes directed obliquely, one on each side of the hinder end of the body. They have slightly irregular margins and measure 0·12—0·17 × 0·07—0·12 in size. The vasa efferentia pass forwards and open into the posterior end of the vesicula seminalis which is enormously developed measuring 0·38—0·42 × 0·07 in size. It is roughly retort-shaped with its long axis placed transversely in the space between the acetabulum and the receptaculum seminis and is narrowed antèriorly to form a fairly long tubular ejaculatory duct of 0·1—0·12 × 0·03 size which lies to the right side of the acetabulum. Terminally the ejaculatory duct joins the uterus just before the genital pore forming the genital sinus. There is no cirrus sac present.

The ovary is situated a little to the right side about the middle of the post-acetabular region between the right testis and the coils of the uterus. It has an irregular outline, measuring 0·08—0·1 × 0·11—0·14

(over)

in size. The receptaculum seminis, somewhat rounded in outline, lies in the median line in level with and partially overlapping the ovary and the yolk reservoir. Its size varies with the amount of its contents ranging from 0·08—0·13 in length and 0·1—0·13 in breadth. A short but fairly wide Laurer's canal is present.

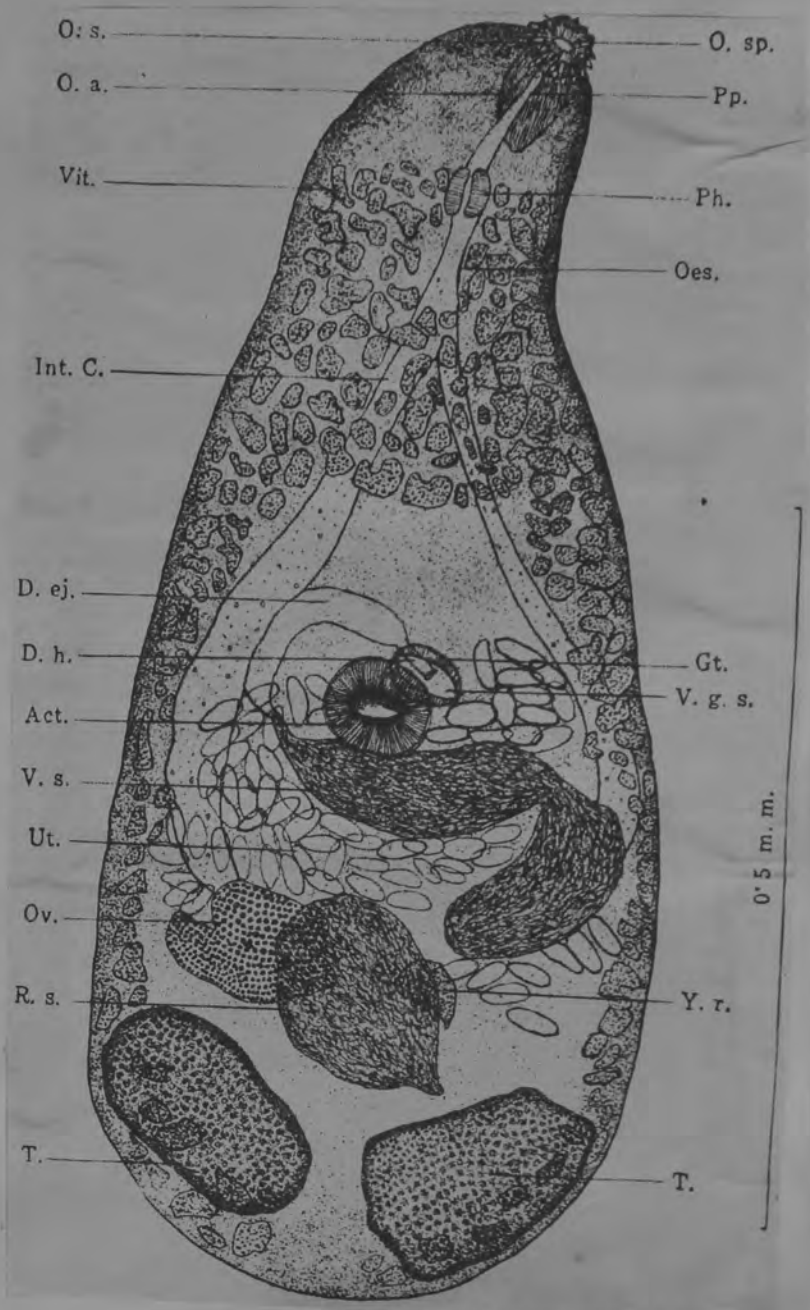
The vitellaria consisting of small irregular follicles of 0·01—0·04 × 0·008—0·02 size, are profusely developed and extend laterally from the anterior level of the pharynx to the posterior ends of the testes. Anteriorly in the region from the pharynx to a little distance behind the intestinal bifurcation the vitelline follicles of the two sides meet in the median line. A small yolk reservoir lies slightly to the left of the median line between the posterior end of the vesicula seminalis and the receptaculum seminis, partly overlapping the latter.

The uterus composed of a wide S-shaped ascending coil is confined to the space between the testes and the ventro-genital sinus, never extending beyond the latter. It is packed with a fairly large number of large sized, yellowish brown, operculate eggs of 0·03—0·035 × 0·015—0·017 size.

A. intermedius N. Sp. is assigned to the sub-genus (*Phagicola*) Travassos on account of the length of the oesophagus and of the intestinal caeca and the extent of the uterus. This species resembles the sub-genus (*Ascocotyle*) Travassos in the arrangement of oral spines and the relatively large extent of the vitellaria but it differs from it in the presence of a fairly long oesophagus followed by long caeca which extend far behind the acetabulum and in the extent of the uterus which never extends in front of the genital sinus; features in which it resembles *A.* (*Phagicola*). It differs from all the species of the latter sub-genus in the enormous development and extent of the vitellaria and in having a double crown of oral spines. Within the sub-genus, in the arrangement of the oral spines it resembles *A.* (*Phagicola*) *angeloi* and *A.* (*Phagicola*) *nana*, in the latter species only the dorsal spines are in double row. *A. intermedius*, however, differs from all the species of the genus in the number of oral spines, much larger extent of the vitellaria and the size of its eggs which are the largest in the genus.

The genus *Phagicola* as now constituted by Price differs from *Ascocotyle* only in the presence of an oesophagus, the length of the intestinal caeca which extend posteriorly beyond the acetabulum, the post-acetabular position of the vitellaria, the extent of the uterus which never extends anteriorly beyond the ventro-genital sinus. The intermediate species described in this paper connects the two genera—*Ascocotyle* and *Phagicola*—as regards the extent of the vitellaria. The remaining important differences between the two genera are the extent of the intestinal caeca and the uterus. The extent of the intestinal caeca cannot in this case be considered of generic importance as all the gradations in their length exist between such forms as *Phagicola minuta* and *P. arnaldoi*. The extent of the uterus alone does not offer a sufficient justification for maintaining two distinct genera. We, therefore, agree with Travassos in reducing the genus *Phagicola* to the rank of a sub genus.

Heterphyidae



From Srivastava, 1935

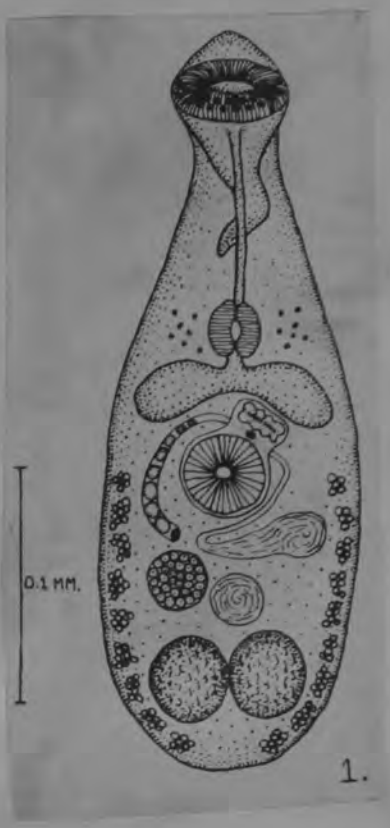
Ascocotyle (A.) leighi Burton, 1956

Ascocotyle leighi, n. sp.

(All measurements in millimeters; 10 specimens, 72 hours or older, were measured)

Diagnosis: with characters of the genus. Small distome. Body pyriform, concave ventrally, 0.283 to 0.402 (av. 0.339) long by 0.084 to 0.122 (av. 0.099) wide at level of acetabulum. Anterior end 0.038 to 0.059 (av. 0.050) wide at level of lateral expansions of oral sucker and exhibiting an anterior lip-like projection. Cuticula entirely scaly-spinose. Unevenly distributed pigment granules, probably remnants of cercarial eyespots, persisting dorsally in regions lateral to pharynx. Oral aperture terminal and surrounded by double row of 48 to 52 spines (24 to 26 in each row) directed posteriorly, those of anterior row 0.012 to 0.014 (av. 0.013) long and those of posterior row 0.009 to 0.011 (av. 0.010) long. Oral sucker elongate and conical, with posterior muscular projection which is often contracted into an "S" shape; acetabulum 0.031 to 0.042 (av. 0.036) in diameter, slightly post-equatorial, and retractable into ventro-genital sinus. Prepharynx 0.035 to 0.105 (av. 0.073) long, slender, ventral to posterior projection of oral sucker; pharynx 0.028 to 0.035 (av. 0.032) long by 0.021 to 0.028 (av. 0.023) wide; esophagus very short; intestinal ceca short and expanded, terminating just anterior to acetabulum. Ventro-genital sinus median, with single preacetabular gonotyl lying to left of median line. Seminal vesicle large and located left, slightly curved, extending transversely on level with anterior margin of ovary and tapering toward ovarian end into ejaculatory duct; ejaculatory duct turns abruptly left and arcs around left side of acetabulum to point near gonotyl, where it joins with metraterm to form common duct opening into ventro-genital sinus through genital pore between gonotyl and acetabulum. Testes spherical to ovoid, side by side at posterior end of body, 0.036 to 0.049 (av. 0.042) in diameter, and usually in contact with each other. Ovary spherical, 0.021 to 0.028 (av. 0.026) in diameter, anterior to, and in proximity of, right testis. Seminal receptacle spherical and median, although sometimes displaced slightly left, on level with posterior margin of ovary. Vitellaria lateral, extending from near posterior end of body to level of aperture of acetabulum. Uterus extending into posttesticular region, joining with ejaculatory duct dorsal to gonotyl to form common genital duct. Eggs 0.016 to 0.018 (av. 0.017) long by 0.009 to 0.011 (av. 0.010) wide.

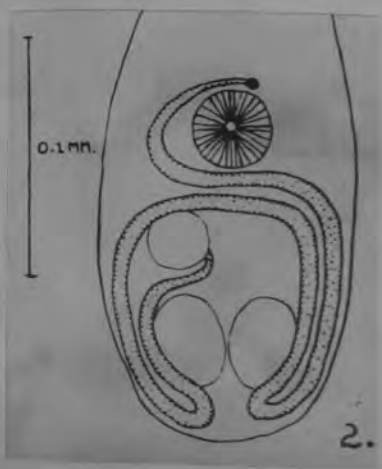
Experimental host: Day-old chicks. Natural host unknown, probably piscivorous birds.
Location: Posterior region of small intestine.
Distribution: South Florida.
Cotypes: U.S.N.M. Helm. Coll. No. 38161.



1.

A search for the natural host was without success, and as a result, the description of *Ascocotyle leighi* is based on adults recovered from day-old unfed chicks which were infected with metacercariae. Infections of 28 chicks were attempted, 16 of which were successful. The adults undergo a transient development in the posterior part of the small intestine, reaching the egg-producing, but not the egg-liberating stage, after 66 to 72 hours of incubation. Shortly thereafter their numbers progressively diminish, no adults being recovered after 119 hours of incubation. Attempts to infect mice with the metacercariae were unsuccessful.

This trematode is named in recognition of Dr. W. Henry Leigh of the University of Miami Zoology Department.



2.

Ascocotyle leighi may be readily differentiated from all other members of the genus by the number of spines in the oral coronet. *A. tenuicollis* Price, 1935, and *A. puertoricensis* Price, 1935, are the two species most closely resembling *A. leighi*, but may be separated on the basis of the number of spines in the oral coronet and the respective positions of the seminal vesicles. Both *A. tenuicollis* and *A. puertoricensis* have a total of 32 spines in their oral coronets (16 in each of 2 rows). This contrasts with a total of 48 to 52 spines in the coronet of *A. leighi* (24 to 26 in each of 2 rows). The seminal vesicles of *A. tenuicollis* and *A. puertoricensis* taper anteriorly from a bulb-like expansion. In *A. leighi* the vesicle lies on a transverse plane and tapers medially toward the ovary.


3.

A total of 341 *Mollienesia latipinna* were examined and only 12 were devoid of infection. The metacercariae were not observed in any part of the host anatomy other than the conus arteriosus, and as many as 30 or 35 cysts were frequently recovered from a single conus. Specificity of the metacercariae for *Mollienesia* seemed apparent, for examinations of other small fishes in the area of collection proved negative.

Sections through the conus of infected *Mollienesia* showed that the metacercariae cyst in the wall immediately under the endothelium. Growth of the metacercariae toward the lumen results in occlusion of the vessel to the point of possible interference of arterial blood flow.

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Table. *The known hosts and geographical distribution of A. leighi*

Second Intermediate Hosts	Definitive Hosts	Locality	Authority
Belonesox belizanus KNER		Progresso, Yucatan, Mexico	This paper
Cyprinodon variegatus LACEPEDE		Alligator Harbor, Florida	This paper
		Miami, Florida	LENHOFF, SCHROEDER and LEIGH (1960)[1]
		Lake Pontchartrain, Louisiana	This paper
		Grand Terre, Louisiana	This paper
		Galveston Bay, Texas	This paper
Mollienesia latipinna LE SUEUR		Miami, Florida	BURTON (1956)
		Lake Pontchartrain, Louisiana	SOGANDARES and BRIDGMAN (1960)
			This paper
		Grand Terre, Louisiana	This paper
		Galveston Bay, Texas	This paper
Mollienesia sphenops (CUV. and VAL.)		Progresso, Yucatan, Mexico	This paper
	Procyon lotor LINN.	Cape Island, South Carolina	HARKEMA and MILLER (1962)
		Sarpy, Louisiana	This paper
		Pass-a-Loutre, Louisiana	This paper
	Gallus domesticus LINN.	Experimental	BURTON (1956)
			This paper
	Hydranassa tricolor (MULLER)	Grand Terre, Louisiana	This paper
	Casmerodius albus LINN	Galveston Bay, Texas	This paper

[1] Reported as *Ascocotyle* sp.

1. *Ascocotyle leighi* Burton, 1956

Second intermediate host in Louisiana.—*Mollienisia latipinna* LeSueur, sail-fin molly (family Poeciliidae).

Location.—In lumen of conus arteriosus and lumen and wall of ventricle of heart.

Locality of second intermediate host.—West end of U. S. Highway 11 Causeway, south shore of Lake Pontchartrain, Louisiana, new locality record.

Discussion.—Burton (1956) described this species from specimens collected from the conus arteriosus of *Mollienisia latipinna* in Florida. He was able to obtain gravid adults from experimental infections in chicks, but was unable to observe the flame cell pattern which in our specimens is 2[(2 + 2) + (2 + 2)].

Price (1936) sectioned specimens of *Ascocotyle megalocephala* Price, 1932, but did not report a membrane surrounding the muscular oral appendage of this species. Metacercariae of *Ascocotyle leighi* collected from the heart of *Mollienisia latipinna* from Lake Pontchartrain, Louisiana, were examined microscopically for details of the muscular oral appendage. This appendage seems to be surrounded by a thin, well defined, membrane which is continuous with at least the basal portion of the oral sucker. This membrane is not apparent in whole mounts stained with Delafield's hematoxylin and can best be observed in live material when the tip of the appendage is contracted. When the appendage is relaxed, the surrounding membrane seems to stretch and adhere so closely to the appendage that it is difficult to observe. The overlap of the muscular oral sucker appendage with the pharynx varies as has been clearly pointed out by Martin (1953) and Stunkard and Uzmann (1955) for *Parascocotyle lageniformis* and *Parascocotyle diminuta* respectively. Prolonged observations of *Ascocotyle leighi* metacercariae, under slight coverslip pressure, revealed that the extension of the forebody did not always control the length of the muscular oral appendage. Variation in position of the appendage is due to extension of the appendage as well as contraction of the forebody which in turn shortens the distance between the pharynx and oral sucker. The latter factor seems to be the major cause of variation.

The ventrogenital sac wall of metacercariae of *Ascocotyle leighi* varies in shape. Live metacercariae were observed, under a floated coverslip, to orient the acetabular concavity anteriorly and to clasp the wall of the ventrogenital sac. Repeated observations revealed that this acetabular sucking action modified the shape of the ventrogenital sac wall. Perhaps acetabular manipulations occasionally serve the purpose of ejecting eggs from the ventrogenital sac in gravid worms.

The gonotyl of *Ascocotyle leighi* is as pictured by Burton (1956). The gonotyl fills most of the ventrogenital sac and appears to be provided, when live material is studied under 1,250X magnification, with a patch of very minute spines on its ventral surface adjacent to the ventrogenital sac membrane. The gonotylar spines are not visible in specimens stained with Delafield's hematoxylin.

FROM SOGANDARES-BERNAL AND BRIDGEMAN, 1960

Ascocotyle mcintoshi Price, 1936

(Рис. 93)

Дефинитивный хозяин: *Guera alba*.

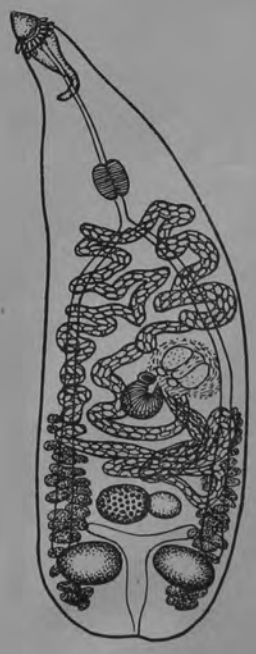
Локализация: кишечник.

Место обнаружения: США (Флорида).

Описание вида (по Прайсу, 1936). Тело продолговато-грушевидное, 1,20 мм длины и 0,192—0,368 мм ширины. Кутикула покрыта мелкими чешуевидными шипиками, расположенными по всему телу от ротового отверстия до экскреторной поры. Передний конец тела 0,044—0,065 мм ширины и снабжен треугольным дорзальным сосочком. Ротовое отверстие терминальное и окружено двумя рядами шипов, по 18—20 в каждом ряду. Шипы переднего ряда 0,018 мм длины, шипы заднего ряда 0,011 мм. Ротовая присоска продолговато-коническая; ее задняя вершина расположена на половине длины расстояния между ротовым отверстием и фаринксом. Брюшная присоска 0,044—0,082 мм в диаметре; ее полость открывается в генитальный синус; половое отверстие открывается медианно или субмедианно, постэкваториально. Генитальный синус обширный и содержит в себе одну большую половую присоску (гонотиль), по форме напоминающую кочан цветной капусты. Префаринкс тонкий, 0,148—0,240 мм длины. Кишечные ветви тонкие, тянутся назад до переднего края семенников. Пищевод короткий, 0,022—0,055 мм длины. Семенной пузырек искривленный и сжатый посередине; его основание лежит слегка впереди яичника. Семенники поперечно-овальные; левый семенник меньше правого; расположены неподалеку от заднего конца тела. Левый семенник 0,052—0,074 мм длины и 0,063—0,100 мм ширины; правый семенник 0,066—0,074 мм длины и 0,066—0,110 мм ширины. Яичник шаровидный, поперечно-овальный, 0,040—0,084 мм длины и 0,066—0,092 мм ширины, лежит впереди семенников, немного правее медианной линии. Семяприемник округлый, располагается медианно в зоне яичника. Желточники тянутся по бокам тела от уровня заднего края брюшной присоски до заднего конца тела. Матка извилистая, тянется вперед от яичника до места бифуркации кишечника. Яйца 0,018 мм длины и 0,011 мм ширины.

Этот вид отличается от других представителей рода *Ascocotyle* длинными кишечными ветвями.

Литература: Price, 1936, стр. 31—32.



Ascocotyle megalocephala Price, 1932

(Рис. 90)

Дефинитивный хозяин: *Butorides* sp.

Локализация: кишечник.

Место обнаружения: Пуэрто-Рико.

Описание вида (по Прайсу, 1932). Тело кубкообразное, 0,340—0,510 мм длины и 0,120—0,220 мм ширины. Передний конец широкий, задний тупо-закругленный. Кутикула покрыта мелкими шипиками. Ротовое отверстие расположено терминально и окружено двумя коронами шипов, по 36 в каждом ряду. Шипы каждого ряда 0,027 мм длины и 0,005 мм ширины. Ротовая присоска большая со слепым задним коническим отростком, который заканчивается на уровне фаринкса. Префаринкс тонкий, около 0,050 мм длины. Фаринкс продольно-овальный, 0,040—0,054 мм длины и 0,025—0,030 мм ширины. Пищевод очень короткий. Кишечные ветви тянутся до уровня переднего края брюшной присоски. Генитальное отверстие открывается иммедианно впереди брюшной присоски. Генитальный синус маленький, закрыт брюшной присоской. Семенной пузырек ретортообразный, лежит в дорзальной плоскости и простирается к передней части левого семенника. Семенники шаровидные или немного больше в ширину, чем в длину, 0,048—0,089 мм в диаметре, лежат в задней части тела один против другого. Яичник шаровидный, 0,040—0,045 мм в диаметре, антеро-дорзальнее правого семенника. Семяприемник медианнее и сзади яичника закрывает задний конец семенного пузырька. Лауреров канал имеется, открывается дорзально неподалеку от уровня переднего края семенного пузырька. Желточники простираются от уровня заднего края фаринкса до центра брюшной присоски. Матка впереди семенников; ее петли тянутся впереди фаринкса. Яйца 0,018—0,020 мм длины и 0,009—0,011 мм ширины.

Этот вид отличается от других видов своеобразной формой тела, числом околоротовых шипов, расположением желточников и протяжением матки.

Ротовое отверстие ближе к вентральной части присоски, а конический отросток имеет на всем протяжении мускулистую структуру, следовательно, он является модификацией присасывательного аппарата.

Литература: Price, 1932, стр. 166—167.

SCHROEDER AND LEIGH, 1965

Ascocotyle pachycystis sp. n.

The adult (Figs. 1, 5, 6)

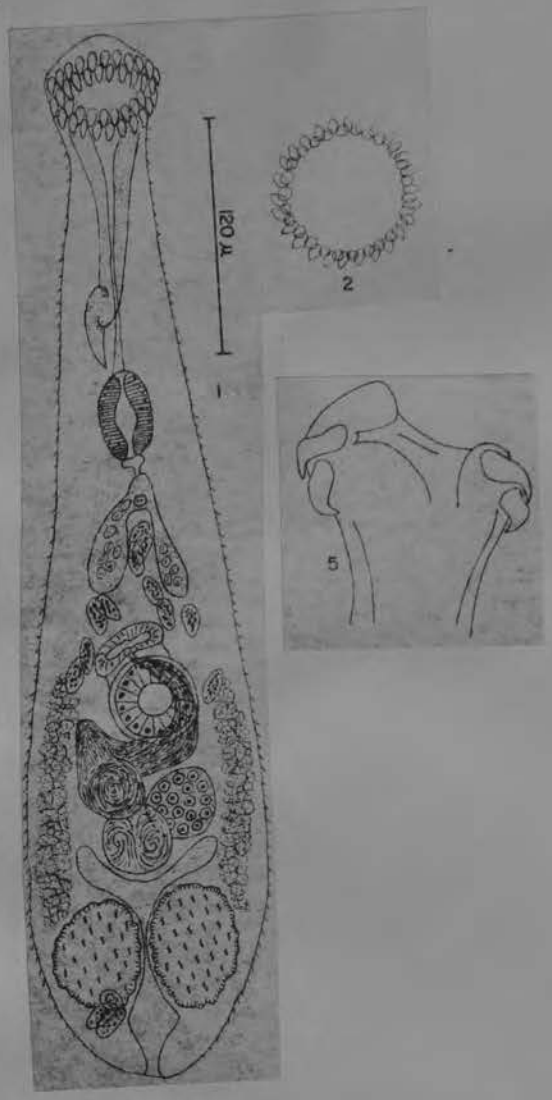
Description (based on 20 specimens), with characters of the genus: Body pyriform, concave ventrally, 470 to 679 (573) by 127 to 158 (143); anterior end 50 to 80 (69) wide at level of lateral expansions of oral sucker, exhibiting an anteroventral liplike projection. Entire cuticula scaly throughout, much more obvious on anterior portions of body. Oral aperture terminal, surrounded by double row of 44 to 58 spines (22 to 29 per row) directed posteriorly. Number of spines in anterior and posterior rows may differ by one spine in some specimens. Anterior spines average 14 long, posterior spines 11. Oral sucker elongate and conical, with posterior muscular projection, often contracted into "S" shape. Acetabulum 38 to 53 (46) in diameter; slightly postequatorial; retractable into metrogenital sinus. Prepharynx long, slender, ventral to posterior projection of oral sucker. Pharynx 40 to 80 (46) by 22 to 40 (29). Esophagus short. Intestinal ceca short, extending posteriorly, almost parallel, terminating well anterior to acetabulum and genotyl in most specimens, occasionally containing corpuscles resembling red blood cells. Ventral genital sinus median, with simple preacetabular genotyl lying slightly to left of midline. Testes lobed, side by side at posterior end of body, 70 to 100 (78) by 44 to 63 (52), usually contiguous. Seminal vesicle large, located slightly to left of midline, curved, extending transversely on level of anterior margin of ovary and tapering toward ovarian end. Ovary spherical to ovoid, 38 to 62 (50) by 28 to 45 (36) immediately anterior to right testis. Seminal receptacle roughly spherical, median, and not displaced considerably to left, its center usually on level with or anterior to the near anterior margin of the ovary. Vitellaria lateral, extending from near posterior end of body to level of anterior edge of acetabulum. Uterus extending from genital pore almost to fork of ceca. Eggs [illegible] by 8 to 11 (9). Excretory pore terminal, often obscured by testes.

Host. Pelecanus occidentalis L.

Habitat. Small intestine.

Locality. South Florida.

Holotype. USNM Helm. Coll. No. 60099. The specific name of *A. pachycystis* refers to the exceptionally thick-walled metacercarial cyst.



DISCUSSION

Burton (1958) gives a key to the genus *Ascocotyle* which separates *A. leighi* Burton 1956 from other species by possessing 48 to 52 spines in the oral coronet. *A. pachycystis* resembles *A. leighi* in this respect, but its oral spines are slightly smaller than those of *A. leighi*, and differently shaped (Figs. 5, 6).

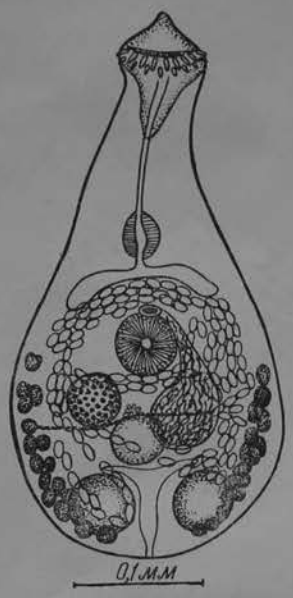
A. pachycystis also has a shorter oral lip than *A. leighi*, and a more acute angle between the intestinal ceca. After becoming familiar with the material, the authors were able to distinguish both the adults and cercariae of the two species under the dissecting microscope, but they are so similar they probably would not have been separated were it not for their differential host specificities.

M. latipinna seldom are infected naturally with more than 100 *A. leighi* metacercariae even when collected in areas where every fish is infected. By comparison, naturally infected *C. variegatus* from such areas usually contain 1,000 or more *A. pachycystis* cysts, and may contain up to 8,000. In heavy infections the *bulbus arteriosus* is enlarged to 20 times its normal size. The reason for this difference between the two species is not clear, as in experimental infections *A. leighi* will invade the *bulbus* of *M. latipinna* by the hundreds, killing the fish. There were no experiments to deter

Ascocotyle puertoricensis Price, 1932

(Рис. 91)

Дефинитивный хозяин: *Butorides* sp.
Локализация: кишечник.
Место обнаружения. Пуэрто-Рико.



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Ascocotyle sexidigita ~~Price~~ Martin & Steele, 1970
(Figs. 1, 4)

Body pyriform to cylindrical depending on state of contraction. Body length 0.35–0.81, av. 0.57 (measurements based on 16 egg-bearing specimens); maximum body width 0.14–0.29, av. 0.24. Integument covered with small spines arranged in quincuncial pattern.

Prepharynx about 0.05 long, opens into ventral side of oral appendage. Pharynx oval, 0.034–0.05, av. 0.045 long, 0.02–0.047, av. 0.033 wide. Esophagus length varies with degree of contraction but when extended is about 0.05 long. Prepharynx and esophagus walls contain fine longitudinal and transverse muscle fibers. Ceca relatively short, not reaching acetabular level in extended specimens. Mouth surrounded by coronet of two rows of spines of nearly equal size, each row having 29–30 spines. Spines of anterior row average about 10 μ in length, while those of the posterior row average about 9μ. Oral appendage extends to pharynx and turns back on itself a short distance, or if nearly straight, extends posterior to pharynx, has muscular sheath and cellular core, when contracted it produces an expansion of spine-bearing region, averages about 0.08 in transverse diameter. Dorsal to mouth is a protrusible lip upon whose anterior margin are openings of 14 cephalic glands retained from the metacercarial stage plus those of about 12 short tubular glands. Ventral sucker 0.038–0.056, av. 0.048 in length, 0.037–0.06, av. 0.05 in width, enclosed in ventro-genital sack. Vitellaria consist of numerous small follicles laterally placed, extending between the ovarian level to near level of pharynx. Right and left vitelline ducts empty into slightly expanded common duct just anterior to testes. Ovary usually on right side in posterior part of body between testes and acetabulum, 0.042–0.07, av. 0.059 in length, 0.042–0.08, av. 0.066 in width. Laurer's canal present; Mehlis' gland at the anterior testes level. Close to Mehlis' gland, but more median, is a seminal receptacle usually distended with sperm. Uterus ascends nearly to pharyngeal level, passes posteriorly to near acetabular level, then anteriorly again to pharyngeal level, all on the right side of body, then passes transversely to left side of body where similar pattern is followed and terminates at ventro-genital sack, beginning loops of uterus contain many free yolk granules as well as eggs. Eggs operculate, colorless when newly formed, but turn brown with age, 15–19, av. 16 μ long, 6–9, av. 8 μ wide. Two spherical to oval testes located in posterior part of body. In living specimens, testicular surface is weakly lobed but smooths out under fixation pressure. Right testis averages 0.122 long and 0.059 wide, while left is 0.116 long and 0.06 wide. Vasa efferentia extended from testes to unite before emptying into seminal vesicle. Seminal vesicle a large sac immediately posterior to acetabulum, empties by way of muscularly-walled duct into ventro-genital sack. Ventro-

1.

4.

4. Gonotyl with six digits and calcareous (?) supports.

genital sack encloses acetabulum and a gonotyl, the latter having six short, finger-like projections each enclosing what appears to be a calcareous deposit too poorly organized to be called a spine. Excretory pore terminal. Excretory bladder has scalloped margins and two arms that extend to ovarian level. Excretory pattern of flame cells is 2 [(2 + 2) + (2 + 2)] = 16.

Type specimen deposited in the Hancock Foundation Parasitology collection No. 691. Paratypes in W. E. Martin's collection.

Host (experimental): *Gallus domesticus.*

Habitat: Ceca and large intestine.

Locality: Southern California.

Bolsa Chica Gun Club near Huntington Beach

Metacercaria

(Figs. 2, 3)

The metacercariae were found in and on the stomach and intestinal walls of the killifish, *Fundulus parvipinnis parvipinnis*. Apparently the cercariae penetrate the wall to the submucosa where they encyst. The submucosa increases in thickness and a rich supply of vascular passages is provided to assure the growing encysted worm a good supply of nutrients. As the cyst enlarges, the muscularis layer is disrupted. The cysts bulge from the wall of the gut and may even produce pedunculate bodies. Cysts, including modified host tissues, are 0.154–0.35, av. 0.26 in diameter. Diameters of metacercarial cysts without host tissues are 0.084–0.252, av. 0.147 in diameter. The cyst wall, presumably secreted by the trematode, is 6–12, av. 10 μ in thickness. The worm in the cyst is bent upon itself. The excretory bladder is greatly distended with fluid that contains globules of various sizes. Small, fairly uniform in size, globules adhere to the wall of the bladder. The ceca are filled with circular, flattened concretions of fairly uniform size. The gonads are evident. Excretory pattern is similar to that of the adult.

Different sizes of metacercariae were found along the *Fundulus* digestive tract. Younger worms lacked the thick cyst wall characteristic of fully grown metacercariae. This wall stained yellow with Mallory's triple stain suggesting a possible lipid-protein material. Lenhoff, Schroeder, and Leigh (1960) examined the metacercarial cysts of *Ascocotyle* obtained from the Southern Sheepshead killifish, *Cyprinodon variegatus* Lacépède, and found them to contain hydroxyproline and be collagen-like, apparently the first report of such material in the phylum Platyhelminthes. Lumsden (1968) described the ultrastructure of *Ascocotyle chandleri* cysts from the liver of *Cyprinodon variegatus* and stated that the cyst wall did not contain collagen though collagen fibers of host origin may be adjacent to the cyst.

Development

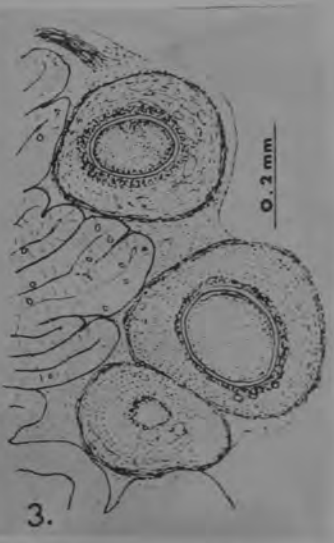
A series of seven hatchery-raised chicks were fed metacercariae and examined 1, 2, 3, 6, 7, 8 and 9 days after feeding. The worms reached the ceca of the host within the first day. They were firmly attached and had host cecal material in their ceca. No eggs were produced. At two days after feeding there was some growth; there were sperm in the seminal vesicle, but no eggs were produced. The same held true for three-day old worms. Eggs were present at six days and thereafter. At nine days some of the worms were found in the large intestine, possibly the beginning of elimination of the worms from host. Schroeder and Leigh (1965) reported that *Ascocotyle pachycystis* matured in the ceca of chicks, but that they were eliminated after a few days.

Discussion

The genus *Ascocotyle* was proposed by Looss (1899) with the type species *A. coelostoma* (Looss, 1896) which he had found in the ceca and large intestine of a pelican collected in Egypt. Most of the additional species of this genus are listed by Hutton and Sogandares-Bernal (1958). Species of the genus described since 1958 include *A. ampullacea* Miller and Harkema, 1962; *A. chandleri* Lumsden, 1963; and *A. pachycystis* Schroeder and Leigh, 1965. The gonotyl of *A. sexidigita* with six digits supported by deposits distinguishes this species from all others in the genus. In circumoral spine count *A. sexidigita* is closest to *A. leighi* Burton, 1956 which has 48–52 spines. However, in *A. sexidigita* the vitellaria are mainly preacetabular, while in *A. leighi* they are mainly postacetabular. Also, the metacercariae of *A. sexidigita* are found in the intestinal wall and not in the heart of the fish host, while *A. leighi* metacercariae are found only in the heart. *A. pachycystis* has 44–58 circumoral spines, but the vitellaria are distributed as in *A. leighi*.

The life cycle of *A. pachycystis* was worked out by Schroeder and Leigh (1965). They reported the raccoon as the definitive host in southern Florida, the fish, *Poecilia (Mollienesia) latipinna* (Le Sueur, 1821) Rosen, 1963 as the second intermediate host, and the snail, *Littoradinops tenuipes* (Couper) as an experimental first intermediate host. They described the cercaria as ocellate and parapleurolophocercous with the fins extending the full length of the tail. To date we have not found such a cercaria in the region where the fish are infected. They further stated that there were four penetration glands on each side of the body, but we suspect that only one bundle of gland ducts was counted on each side. We found seven on each side in the metacercariae and adults of *A. sexidigita*. It has been demonstrated that many related heterophyid cercariae have a 3-4-4-3 arrangement of cephalic or penetration gland ducts (Martin, 1950, 1958, Martin and Kuntz, 1955).

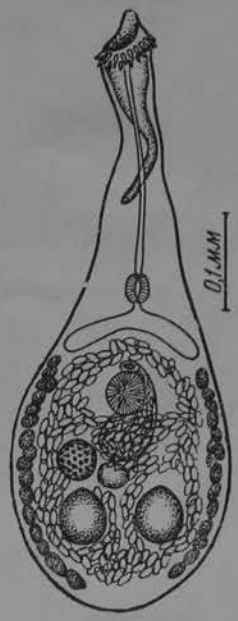
2. Cross section of fish intestine showing three metacercarial cysts.



3. Cyst area enlarged.

Ascocotyle tenuicollis Price,1953

Host: Botanurus lentoginosus



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LOOSE LEAF
ORGANIZER

SCHEDULE

PERIOD OR TIME								
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COURSE **TUE.** INSTRUCTOR								
COURSE **WED.** INSTRUCTOR								
COURSE **THU.** INSTRUCTOR								
COURSE **FRI.** INSTRUCTOR								
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ASCOCOTYLE